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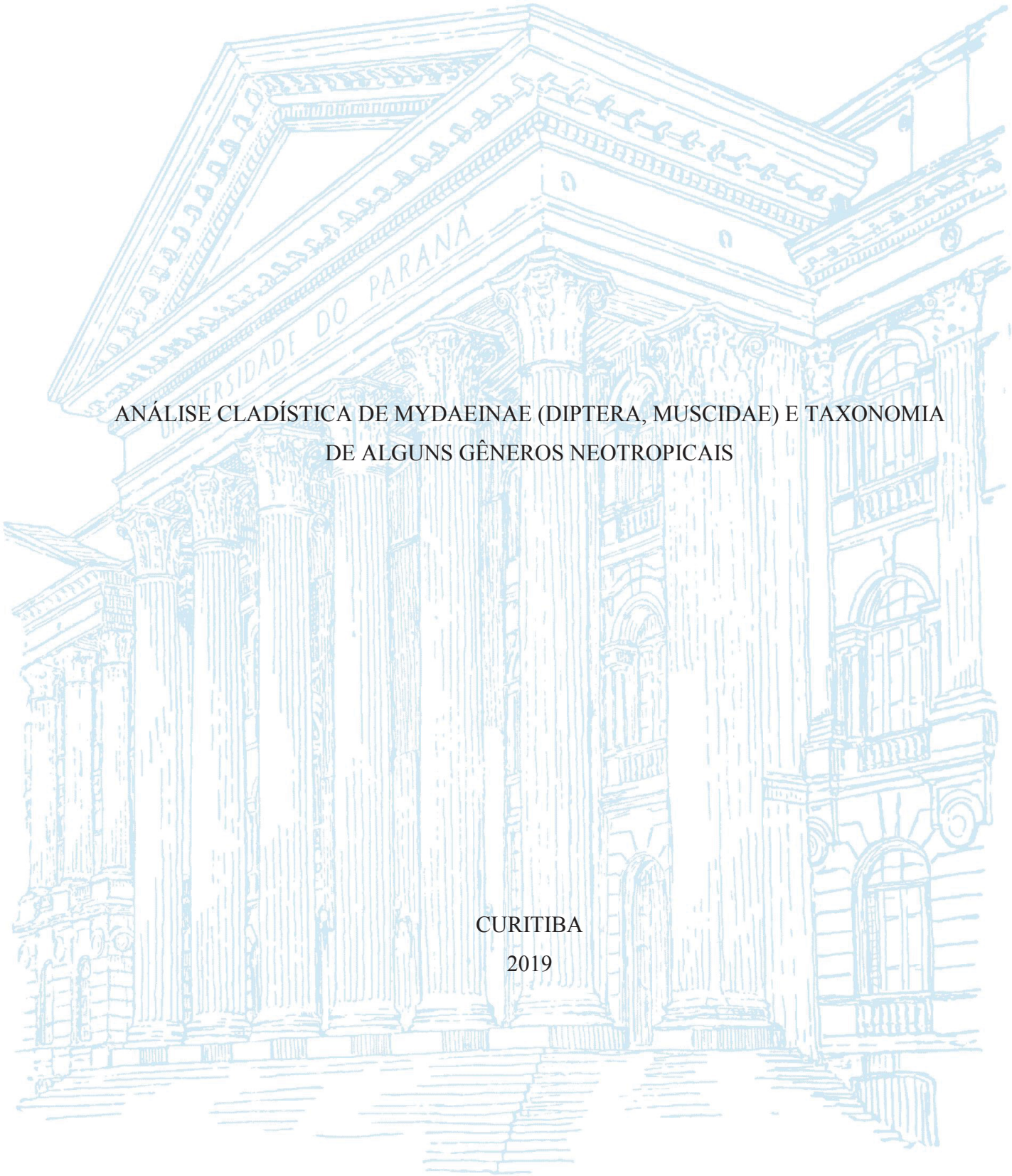

ANÁLISE CLADÍSTICA DE MYDAEINAE (DIPTERA, MUSCIDAE) E TAXONOMIA DE ALGUNS GÊNEROS NEOTROPICAIS

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ANÁLISE CLADÍSTICA DE MYDAEINAE (DIPTERA, MUSCIDAE) E TAXONOMIA DE ALGUNS GÊNEROS NEOTROPICAIS.

Tese de Doutorado apresentada à Coordenação do Programa de Pós-Graduação em Ciências Biológicas (Área de concentração em Entomologia), do Setor de Ciências Biológicas da Universidade Federal do Paraná, como requisito parcial para a obtenção do título de doutor em Ciências Biológicas.

ORIENTADOR: PROF. DR CLAUDIO JOSÉ BARROS DE CARVALHO

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Os membros da Banca Examinadora designada pelo Colegiado do Programa de Pós-Graduação em CIÊNCIAS BIOLÓGICAS (ENTOMOLOGIA) da Universidade Federal do Paraná foram convocados para realizar a arguição da tese de Doutorado de **JOAO MANUEL FOGACA** intitulada: **Análise cladística do Mydaeinae (Diptera, Muscidae) e taxonomia de alguns gêneros Neotropicais.**, após terem inquirido o aluno e realizado a avaliação do trabalho, são do parecer pela sua Aprovação no rito de defesa.

A outorga do título de doutor está sujeita à homologação pelo colegiado, ao atendimento de todas as indicações e correções solicitadas pela banca e ao pleno atendimento das demandas regimentais do Programa de Pós-Graduação.

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RESUMO

Muscidae é uma diversificada família de moscas (Ordem Diptera) presente em todas as regiões biogeográficas, com 5210 espécies. Dos 84 gêneros com registro para a Região Neotropical, 80 são encontrados na América do Sul. De acordo com a mais recente hipótese filogenética proposta para Muscidae, três subfamílias podem ser reconhecidas: Muscinae, Cyrtoneurininae e Mydaeinae. Mydaeinae, também distribuída no mundo todo, é a subfamília mais diversa, com mais de 3.000 espécies. Apesar dos recentes estudos taxonômicos e filogenéticos, o conhecimento taxonômico e as relações entre os gêneros são incipientes e incertos. Neste trabalho, nós fornecemos uma filogenia representativa em nível de gêneros usando caracteres morfológicos. Foram análisadas 112 espécies de Mydaeinae, 106 do grupo interno e seis espécies do grupo externo, analisando 73 caracteres morfológicos. Como resultados, Mydaeinae e quase todos os gêneros resultaram monofiléticos, com exceção de *Cordiluroides* Albuquerque, 1954; *Hebecnema* Schnabl, 1889; *Limnophora* Robineau-Desvoidy, *Macrorchis* Rondani, 1877 e *Myospila*, Rondani, 1856. Além disso, todas as espécies neotropicais de *Limnophora* Robineau-Desvoidy (Diptera, Muscidae) foram revisadas e uma nova espécie é descrita *Limnophora* **sp. nov**. **1**, para Minas Genais, Brasil. Redescrições, diagnoses e notas sobre todas as espécies neotropicais são fornecidas, incluindo ilustrações das genitálias masculinas e femininas (quando o material suficiente estava disponível). Pela primeira vez em *Limnophora*, foram realizadas análises da morfologia da probóscide e genitália usando microscópio eletrônico de varredura (MEV). Também, um novo gênero, *Sumapazomyia* **gen. nov**., é proposto para uma nova espécie, *S. inusitata* **sp. nov**., do Parque Natural Nacional Sumapaz, Bogotá, Colômbia. Por fim, uma nova espécie da tribo Coenosiini, *Neodexiopsis omnicapilli* sp. nov. (Diptera, Muscidae), de Palmas, Paraná, Brasil, é descrita e ilustrada. A probóscide e terminálias do macho e da fêmea são descritas usando MEV.

Palavras-chave: Muscidae. Mydaeinae. Filogenia. Revisão. Nova espécie.

ABSTRACT

Muscidae is a large family of flies (Order Diptera) from all biogeographic regions comprising 5210 described species. Of the 84 genera found in the Neotropical Region 80 are found in South America. According to the most recent phylogenetic hypothesis proposed for the family, three subfamilies can be recognized: Muscinae, Cyrtoneurininae and Mydaeinae. Mydaeinae, also distribute worldwide, is the richest subfamily, comprising more than 3,000 species. Despite recent taxonomy and phylogeny studies, the taxonomic studies are incipient and the relationships among the genera remain unclear. Here, we provide a comprehensive genus-level phylogeny using morphological evidence. One hundred and five Mydaeinae species, six outgroups and 73 morphological characters were analyzed. Mydaeinae and almost all genera resulted monophyletic, except for *Cordiluroides* Albuquerque, 1954; *Hebecnema* Schnabl, 1889; *Limnophora* Robineau-Desvoidy, *Macrorchis* Rondani, 1877 and *Myospila*, Rondani, 1856.All Neotropical species of *Limnophora* Robineau-Desvoidy (Diptera, Muscidae) were analyzed. A new species is described *Limnophora* **sp. nov.** 1, from Minas Genais, Brazil. Redescriptions, diagnoses and notes on all species recorded from the Neotropical region are given, including male and female terminalia illustrations (when sufficient material was available). For the first-time, analyses on the ultrastructural morphology using scanning electron microscope (SEM) from proboscis and male genitalia are provided. The new genus, *Sumapazomyia* **gen. nov**., is proposed for a new species, *S. inusitata* **sp. nov**., from National Natural Park Sumapaz, Bogota, Colombia. A new and remarkable genus of the muscid tribe Coenosiini. A new Muscidae, *Neodexiopsis omnicapilli* sp. nov. (Diptera, Muscidae), from Palmas, Paraná, Brazil, is described and illustrated. The proboscis and male and female terminalia are described using ultrastructural morphology

Keywords: Muscidae. Mydaeinae. Phylogeny. Revision. New species.

SUMÁRIO

INTRODUÇÃO

Muscidae é uma numerosa família de Diptera, com cerca de 5.210 espécies descritas e com ocorrência em todas as regiões biogeográficas (Pape & Thompson 2013). Destas, 843 espécies são reconhecidas na Região Neotropical (Carvalho et al. 2005). A principal autapomorfia da família é a perda dos espiráculos pós-abdominais nas fêmeas (Hennig 1965). Possui diversidade em tamanho (2-15 mm) e geralmente apresenta coloração castanho-claro ou castanho-escuro; as asas são na maioria hialina, porém podem apresentar-se amareladas ou com manchas, principalmente nas veias. As espécies podem ser reconhecidas pela ausência da linha vertical de cerdas conspícuas no mero, e a veia subcostal sinuosa divergindo da veia R_1 perto do ápice. A veia A_1 é incompleta não atingindo a margem da asa (Löwenberg-Neto & Carvalho 2013).

Os Muscidae podem ser encontrados em praticamente todos os habitats, exceto em lugares muito áridos. São comuns, em maior diversidade em florestas e bordas e ao redor dos cursos d'água e em altas altitudes representam uma grande parcela da fauna (de Carvalho et al. 2005). A maioria desempenha importante papel na natureza, ajudando na decomposição de matéria orgânica e no controle populacional de certas espécies como alguns afídeos, que são considerados insetos praga. Outras são de importância por serem vetores mecânicos ou transmissores de patógenos quando em contato com o homem e outros animais (de Carvalho et al. 2005).

A monofilia de Muscidae é proposta em vários trabalhos, tanto com análises filogenéticas moleculares (Schuehli *et al.* 2007; Kutty *et al*. 2014; Haseyama 2015), quanto análises morfológicas (Hennig 1965; de Carvalho 1989; McAlpine 1989; Couri & de Carvalho 2003). Hennig (1965) apresentou um estudo preliminar para a sistemática e filogenia de Muscidae, e através da análise de indivíduos adultos propôs uma organização para família. Skidmore (1985) analisou características morfológicas de estágios imaturos e propôs uma classificação com 10 subfamílias, Eginiinae, Reinwardtiinae, Achanthipterinae, Azeliinae, Muscinae, Stomoxyinae, Atherigoninae, Mydaeinae, Coenosiinae e Phaoniinae. de Carvalho (1989) propôs a primeira análise cladística para as subfamílias e tribos de Muscidae, neste trabalho o autor apresentou uma classificação semelhante à de Skidmore, diferindo com a proposta de Stomoxyini como tribo de Muscinae e Reinwardtiini como tribo de Azeliinae. Neste trabalho ele organizou a família em sete subfamílias Achanthipterinae, Atherigoninae, Muscinae com as tribos Muscini e Stomoxini, Azeliinae com as tribos Azeliini e Reinwardtiini, Phaoniinae, Mydaeinae com as tribos Graphomyini e Mydaeini, e Coenosiinae

com as tribos Limnophorini e Coenosiini. Schuehli *et al.* (2007) publicaram o primeiro trabalho utilizando dados moleculares, os autores utilizaram 24 espécies de 19 gêneros divididos em seis subfamílias e corroboraram a monofilia da família. Kutty *et al*. (2014) fizeram o primeiro trabalho molecular com representantes de todas as regiões biogeográficas, neste trabalho os autores corroboraram a monofilia da família e propuseram, dentre as subfamílias, apenas Coenosiinae e Muscinae como monofiléticas, Azeliinae e Reinwardtiini como polifiléticas, e Muscini e Stomoxyini como parafiléticas. Haseyama et al. (2015) apresentaram uma análise molecular sobre a família onde não é corroborada a monofilia das subfamílias, exceto para Atherigoninae que é composta por apenas um gênero. Neste trabalho os autores propõem a classificação da família sem as tradicionais tribos e com apenas três subfamílias: Muscinae, Cyrtoneurininae e Mydaeinae. Esta última proposta é a que foi adotada neste trabalho.

Mydaeinae Verral, 1888 é a subfamília mais diversa em Muscidae. Possui distribuição cosmopolita e atualmente é composta por mais de 3000 espécies distribuídas em 110 gêneros. De acordo com a classificação mais atual (Haseyama et al. 2015) o grupo compreende gêneros das tradicionais subfamílias (*sensu* de Carvalho et al. 2005): Phaoniinae, Mydaeinae e Coenosiinae. Os Mydaeinae estão relacionados ao ambiente aquático podendo ser encontrados ao redor de rios, lagos e ambientes alagados. Apresenta alta diversidade morfológica e comportamental, as espécies podem ser visitantes florais, consumidoras de matéria orgânica em decomposição ou até mesmo predadoras, tanto na fase imatura quanto na fase adulta, por isso, são importantes predadores e contribuem com o controle populacional de outros grupos de insetos, como culicídeos, quironomídeos, simuliídeos e outros pequenos invertebrados de corpo mole como alguns Crustacea e Anphipoda (Werner & Pont 2006).

A principal característica comportamental do grupo é que a maioria das espécies é predadora em alguma fase do desenvolvimento e por isso desempenha importante papel no controle biológico de outras espécies (Werner & Pont 2003). Nesse contexto, para algumas espécies ou grupo de espécies foram feitos trabalhos específicos para conhecer melhor o comportamento de predação e suas preferências alimentares: *Limnophora riparia* Fallen, 1824 (Wotton & Merrit 1988, 2006), *Lispe candicans* Kowarz, 1892 (Steidle 1995), *Lispe neimongola* Tiam & Ma, 2000 (Zhang et al. 2013) e também alguns trabalhos taxonômicos específicos para o levantamento da entomofauna relacionada a gêneros predadores presentes na Armênia *Lispe* (Pont et al. 2012a), *Limnophora* (Pont et al. 2012b), e na Croácia *Limnophora* (Pont & Ivkovic 2013). Werner & Pont (2006) fizeram um trabalho extenso onde combinaram dados da literatura e observações originais e revisaram o conhecimento sobre

territorialismo, captura, predação, corte, cópula e oviposição em "Limnophorini", neste trabalho foi apresentado um sumário dos registros de predadores e presas por Região Biogeográfica.

No contexto da taxonomia de Mydaeinae os estudos são escassos e as incipientes revisões taxonômicas contemplam os grupos menores ou grupos de espécies dentro dos gêneros mais especiosos. A taxonomia é fundamental e a primeira etapa para entender a história de um grupo (Wilson 2004). Conhecer e descrever os organismos sempre foram grandes desafios e se tornam cada vez mais importantes e urgentes na medida em que a velocidade da perda da biodiversidade aumenta (Pimm & Raven 2000). Muitas espécies podem deixar de existir antes mesmo que possamos descrevê-las e conhecer a história das quais elas foram testemunhas (Agnarsson & kuntner 2007; Mace 2004).

Dentre os 110 gêneros alocados em Mydaeinae, *Limnophora* Robineau-Desvoidy, 1830 é, taxonomicamente, um dos maiores e mais problemático. Os adultos de *Limnophora* podem ser reconhecidos pelas seguintes características (Couri & Carvalho 2002): macho com olhos separados por uma largura, não mais do que um quinto do tamanho da largura da cabeça, ao menos nas espécies sul-americanas (Malloch 1934); olho quase sempre nu; 3-4 cerdas pós-suturais dorsocentrais; prosterno com cerdas; asa com cílios em ambos os lados da base do setor radial; primeiro esternito nu. O gênero *Limnophora* apresenta distribuição mundial, com aproximadamente 230 espécies no mundo (Xue *et al.* 2012). Destas, 43 espécies representam o gênero na Região Neotropical. As descrições originais das espécies são antigas e muitas carecem de informações que são úteis para caracterização e identificação das espécies. Não há uma chave de identificação que contemple toda essa diversidade do gênero.

Nesse sentido e mediante ao cenário atual, o incipiente conhecimento taxonômico e as relações filogenéticas de Mydaeinae, este trabalho se justifica por propor: (1) A análise filogenética da subfamilia visando uma maior representatividade de táxons que facilitará o entendimento sobre as relações entre os gêneros. (2) Fazer a revisão taxonômica de *Limnophora,* bem como a produção de uma chave de identificação que apresente caracteres que facilitem a identificação das espécies e incluam também as que ainda não são contempladas nas chaves disponíveis. (3) Descrever um novo gênero para Mydaeinae oriundo dos Páramos colombianos e, por fim, (4) A descrição de uma nova espécie para *Neodexiopsis* Malloch, 1920.

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CAPITULO I

THE PHYLOGENETIC RELATIONSHIPS AMONG THE GENERA OF MYDAEINAE (DIPTERA, MUSCIDAE) BASED ON MORPHOLOGICAL EVIDENCE

The phylogenetic relationships among the genera of Mydaeinae (Diptera, Muscidae) based on morphological evidence

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ABSTRACT

Muscidae flies, comprising about 5,000 species distributed worldwide, are among the ten most speciose families of Diptera. According to the most recent phylogenetic hypothesis proposed for the family, three subfamilies can be recognized: Muscinae, Cyrtoneurininae and Mydaeinae. Mydaeinae, also distribute worldwide, is the richest subfamily, comprising more than 3,000 species. The large number of genera and species represent a challenge for the understanding of the phylogenetic relationships among Mydaeinae. Despite recent phylogenetic studies using morphological and molecular evidence, the relationships among the genera remain unclear. We provide a comprehensive genus-level phylogeny using morphological evidence. One hundred and five Mydaeinae species, six outgroups and 73 morphological characters were analyzed. Almost all genera resulted monophyletic, except for *Cordiluroides* Albuquerque, 1954; *Hebecnema* Schnabl, 1889; *Limnophora* Robineau-Desvoidy, *Macrorchis* Rondani, 1877 and *Myospila*, Rondani, 1856.

INTRODUCTION

Muscidae, with more than 5,000 species described, are one the most speciose family of Calyptratae (Pape et al., 2011). The family is currently classified in three subfamilies Muscinae, Cyrtoneurininae and Mydaeinae (Haseyama et al., 2015). Mydaeinae flies are the

most speciose subfamily, with 110 genera and more than 3,000 described species (Couri & Pont, 1999; Couri & de Carvalho, 2002; Werner and Pont, 2006; Couri, 2008; Couri & de Carvalho, 2013; Michelsen, 2017) distributed worldwide (Hennig, 1965; Skidmore, 1965; Xue & Tian, 2014). Mydaeinae is a diverse group with a wide range of behaviors and includes predators, visitors, dung and carrion visitors (Skidmore, 1985; Pont, 1993; Couri & Pont, 2000; Werner & Pont, 2006).

Monophyly and previous phylogenetic hypothesis

According to the analysis of Haseyama et al. (2015), Mydaeinae is monophyletic and is the sister-group of Cyrtoneurininae. In their classification, Mydaeinae includes genera from Phaoniinae, Mydaeinae and Coenosiinae (*sensu* de Carvalho et al., 2005). The relationships among the Mydaeinae genera are until unclear, but some hypotheses have been proposed based on morphological (Hennig, 1965; Skidmore, 1985; de Carvalho, 1989; Couri and de Carvalho, 2003) and molecular evidence (Schuehli et al., 2007; Kutty et al., 2010, 2014; Haseyama et al., 2015).

Hennig (1965) studied the adult characters of Mydaeinae and proposed relationship among the Muscidae subfamilies. In his classification, Phaoniinae, Mydaeinae, Limnophorinae and Coenosiinae are closely-related. Later, Skidmore (1985) proposed a new classification based on extensive study of muscid immature stages. In his hypothesis, Muscidae was divided in 10 subfamilies; Phaoniinae and Mydaeinae were considered closely-related and were granted tribe status (Limnophorini and Coenosiini) within the Coenosiinae. After that, with the advent of phylogenetic methods, de Carvalho (1989) carried the first and only study focused on the higher-level relationships among muscid flies based on morphological evidence and proposed to divide the family into seven subfamilies. Phaoniinae, Mydaeinae, and Coenosiinae were considered the most apical groups, the latter including the tribes Limnophorini and Coenosiini.

Schuehli et al. (2007) published the first phylogenetic study of Muscidae based on molecular evidence. In their results only two subfamilies were monophyletic: Muscinae and Phaoniinae. Finally, a close relationship among the Phaoniinae, Mydaeinae and Coenosiinae genera was found by Kutty et al. (2010, 2014), but the included tribes were not monophyletic.

Despite studies using morphological and molecular evidence, the relationships among the genera of Mydaeinae remain unclear. Here, we carried out a cladistic analysis of the subfamily Mydaeinae based on morphological evidence from 111 Mydaeinae species, 6 outgroups and 73 morphological characters. A discussion about characters supporting the clades and phylogenetic relationships among the genera are provided.

MATERIAL AND METHODS

Taxon sampling

Sampling was based on previous studies and classifications (de Carvalho et al., 2005; Kutty et al., 2010, 2014; Haseyama et al., 2015) and the material is deposited in the following institutions: American Museum of Natural History, New York, USA (AMNH); The Natural History Museum, London, United Kingdom (BMNH); Coleção de Entomologia Padre Jesus Santiago Moure, Departamento de Zoologia da Universidade Federal do Paraná. Curitiba, Paraná, Brazil (DZUP); Muséum National D'Histoire Naturelle, Paris, France (MNHN); Museu Nacional, Universidade Federal do Rio de Janeiro, Rio de Janeiro, Brazil (MNRJ); Museu de Zoologia da Universidade de São Paulo, São Paulo, Brazil (MZSP); National Museum of Natural History, Washington DC, USA (USNM); Naturhistorisches Museum Wien, Vienna, Austria (NMW); Senckenberg Naturhistorische Sammlungen Dresden, Museum für Tierkunde, Dresden, Germany (SMT); Museum für Naturkunde, Leibniz-Institut für Evolutions- und Biodiversitätsforschung, Berlin, Germany (ZMHU). The adult terminology for the external morphology and terminalia follows Cumming and Wood (2017).

Phylogenetic analyses

The species used in the cladistic analysis are in the Table 1. The analysis included adult characters only. All multistate characters were treated as unordered. The characters are listed in S1, and the data matrix, terminal taxa and character distribution are described in S2.

Construction of the characters

No phylogenetic studies focusing on Phaoniinae and Mydaeinae have been carried out using morphology. Most characters used in this analysis were proposed by Couri & Pont, 2000 – Coenosiini; Couri & Motta, 2000 – *Bithoracochaeta* Stein, 1911; Barbosa, 2010 – Limnophorini. These characters are in their original version or have been modified, and these modifications are described in the characters list. Other characters are new contributions to the literature and are proposed based on the observation of analyzed specimens. The construction of the characters follows Sereno (2007). The matrix was built and edited in the program Winclada 1.61 (Nixon, 2002). The symbol "?" was used for taxa with unknown character states and the symbol "-" for inapplicable characters (S2).

Analysis

The parsimony analysis was performed on the software TNT (Goloboff & Catalano, 2016). The analysis was performed under equal weighting (EW) and implied weighting (IW) (Goloboff, 1993). To IW, values of k (constant of concavity) were used in the "analysis of sensibility" (Wheeler, 1995; Goloboff et al., 2008) to find the chosen tree. All trees and analyses were performed with a space of 99.999 tree in memory and nodes with a minimum length of zero were collapsed. The analysis was performed using New Technology (Sectorial Search, Ratchet, Drift and Tree Fusing) meanly in default mode, but changing the parameters of the Ratchet search for 200 total numbers of interactions, Drift search for 50 cycles and Tree fusing for 5 rounds, Random seed 0, 1000 replications and 100 trees salved. The characters were optimized in the software Winclada 1.61 (Nixon, 2002) and only fast optimizations are

considered. The Relative Bremer Support (Goloboff & Farris, 2001) was used to calculate the branches support in the software TNT, suboptimal trees with length up to 10 additional steps were stored. The tree rooting was established between Muscinae subfamily (Haseyama et al., 2015). The trees were edited on Adobe Illustrator CC.

RESULTS

List of characters

The matrix comprised 104 terminal taxa, 96 ingroup taxa and 8 outgroup taxa. Seventy-two characters from the external and internal morphology of males and females were constructed: 22 from the head, 14 from the thorax, seven from the wings, seven from the legs, five from the abdomen, eigth from the male terminalia and 10 from the female terminalia.

Phylogeny of Mydaeinae

The parsimony analysis using EW resulted in 45 most parsimonious trees. Differently, IW using k=18.6133 resulted just one tree with 698 steps, IC=15, IR=69 (Fig. 1).

DISCUSSION

We present the first study to elucidate the phylogenetic relationships among the genera of Mydaeinae (*sensu* Haseyama et al., 2015) using morphological evidence. The parsimony analysis supported the monophyly of Mydaeinae by five homoplastic synapomorphies: eyes sparsely ciliated (Character 2, state 1), labella 1.5 times larger than width of prementum (Character 21, state 0), anterior intra-alar postsutural seta well developed (Character 28, state 0), anepimeron bare (Character 36, state 0), and mid tibia with two setae on median third on posterior surface (Character 46, state 1). Not used as Character in our analysis, but as emphasized by Skidmore (1985), all Mydaeinae (sensu Haseyama et al., 2015) are obligatory carnivorous (monomorphic or dimorphic species), a putative feature uniting this clade. The monophyly of most Mydaeinae genera was also recovered, except for *Cordiluroides*

Albuquerque, 1954; *Hebecnema* Schnabl, 1889; *Limnophora* Robineau-Desvoidy, *Macrorchis* Rondani, 1877 and *Myospila*, Rondani, 1856.

Our results, for the most part, are congruent with Haseyama et al. (2015). The traditional subfamilies were not recovered. However, the monophyly of the tribe Coenosiini (*sensu* de Carvalho et al., 2005) was supported by one synapomorphy and four homoplastic synapomorphies, respectively: lower proepimeral seta downcurved (Character 23, state 1), fronto-orbital plate bare (Character 16, state 0), proboscis wide (Character 19, state 1), katepisternal setae forming an equilateral triangle (Character 35, state 1), and mid tibia on median third with one seta on posterior surface (Character 46, state 0).

Clade A (Fig. 2. Part A**)** is formed only by *Graphomya* Robineau-Desvoidy, the sister-group of the remaining Mydaeinae. It is supported by 10 homoplastic synapomorphies: distance between eyes larger than ocellar triangle (Character 1, state 2), antenna with microtrichia only on basal half (Character 4, state 0), eyes very ciliated (Character 6, state 2), frontal setae 11 to 16 (Character 15, state 2), fronto-orbital plate setulose (Character 16, state 1), all dorsocentral setae all developed (Character 27, state 1), anal vein long, almost reaching apex (Character 42, state 0), fore tibia with reduced setae on median third of posterior surface (Character 44, state 1) and sternite 5 with base and apex with similar width (Character 53, state 0). *Graphomya* was hypothesized as Mydaeinae (*sensu* de Carvalho et al., 2005). The genus shares some derived Characteristics with Mydaeinae, Limnophorinae and Coenosiinae, especially in shape of the ovipositor. The close relationship between *Graphomya* and Limnophorini (sensu de Carvalho et al. 2005) was supported by Haseyama et al. (2015).

Clade B (Fig. 2. Part B**)** is composed of genera from Phaoniinae (*sensu* de Carvalho et al., 2005), all monophyletic, and Mydaeinae (*sensu* de Carvalho et al., 2005), represented by *Mydaea* and *Myospila*, both also monophyletic. Phaoniinae is represented in our study only

by Neotropical lineages: *Dolichophaonia* Carvalho, 1993; *Helina* Robineau-Desvoidy, 1830; *Phaonia* Robineau-Desvoidy, 1830 and *Souzalopesmyia* Albuquerque, 1951. This clade was supported by five homoplastic synapomorphies: eye very ciliated (Character 6, state 2), palpus filiform (Character 10, state 0), proboscis very wide (Character 19, state 2), male cercus quadrangular (Character 56, state 0) and hypoproct well developed (Character 71, state 1). Hennig (1965) mentioned that the Phaoniinae was probably not monophyletic. Later, studies supported Phaoniinae as a non-monophyletic group (Kutty et al. 2010; 2014; Haseyama et al., 2015). However, Couri and Carvalho (2003) recovered Phaoniinae as a monophyletic group supported by one homoplastic Character: sternite 1 bare. This Character also was found among the Mydaeinae, Coenosiini and Limnophorini. Schuehli et al. (2007) also supported Phaoniinae as monophyletic group. The close relationship between *Mydaea* to Phaoniinae genera had already been found by Kutty et al. (2010) and Haseyama et al. (2015), and to *Myospila* by Kutty et al. (2010).

Clade C (Fig. 2. Part C**)** is formed by other representatives of Mydaeinae (*sensu* de Carvalho et al., 2005) from this analysis, *Hebecnema* Schnabl, 1889 and *Brontaea* Kowarz, 1873, is supported by four homoplastic synapomorphies: dorsocentral setae all developed (Character 27, state 1), katepisternum with many setae (Character 34, state 0), sternite 5 with developed projections on lateral apex (Character 54, state 2), female segment 8 upwards directed (Character 69, state 0). *Hebecnema* resulted paraphyletic in our analysis with respect to *Mydaea*. This close relationship had been first proposed by de Carvalho (1989), but not supported by the analysis of Haseyama et al. (2015).

Clade D (Fig. 2. Part C**)** is composed only of *Xenomyia* Malloch, 1921, and is supported by four homoplastic synapomorphies: arista bare (Character 3, state 0), palpus filiform (Character 10, state 0), proboscis wide (Character 19, state 1) and mid tibia with one seta on posterior surface (Character 46, state 0). *Xenomyia* is a small Afrotropical genus,

probably predaceous, that has Characteristics from Limnophorini: prestomal teeth well developed, prealar absent and katepisternal 1+2 and this analysis it emerged as sister-group of all Coenosiinae (*sensu* de Carvalho et al. 2005).

Clade E (Fig. 2. Part D**)** includes genera from Limnophorini (*sensu* de Carvalho et al. 2005), *Villenaeuvia* Schnabl & Dziedzick, (1911), *Spilogona* Schnabl, 1911 and *Lispe* Latreille, 1797, and is supported by one exclusive synapomorphy and six homoplastic synapomorphies, respectively: phallapodeme greatly enlarged (Character 62, state 1), postpedicel 1.5 larger than pedicel (Character 2, state 1), fore tibia without seta on anterior to anterodorsal surface (Character 45, state 0), hind tibia with one seta on anterodorsal surface (Character 48, state 1), base and apex of sternite 5 similar in width (Character 53, state 0), female tergites 6 and 7 one wide plate (Character 65, state 0) and female segment 8 with reduced spicules (Character 67, state 1). The close relationship between *Villeneuvia* and *Spilogona* was proposed by Kutty et al. (2010). Later, this relationship was recovered (Kutty et al., 2014), but in this study *Spilogona* emerges as sister-group of the *Xenomyia* and this clade is sister-group of the *Villeneuvia*. On the other hand, Haseyama et al. (2015) proposed *Spilogona* as sister-group of the *Lispe*.

Clade F (Fig. 2. Part E**)** is composed of *Ocypodomyia* Pont, 2006 and *Neolimnophora* Schnabl, (1902), and is supported by three homoplastic synapomorphies: arista bare (Character 3, state 0), prosternum setulose (Character 31, state 1), and sternite 5 with no developed projections on lateral apex (Character 54, state 0). Both genera had never been subjected to a phylogenetic study. *Ocypodomyia* is a small genus associated with burrows of crabs. Pont (2006) emphasized, among other characteristics, the bare anepimeron, prealar seta absent, lower proepimeral setulae directed upwards, katepisternal setae not arranged as an equilateral triangle, male hypandrium cup-like. He indicated that the genus belongs to the Limnophorini. In our analysis *Ocypodomyia* is the sister-group of the *Neolimnophora*.

Clade G (Fig. 2. Part E**)** is formed only by *Pachyceramyia* Albuquerque, 1955, and is supported by four homoplastic synapomorphies: gena very developed on vertical direction (Character 13, state 2), hind tibia with one seta on anterodorsal surface (Character 48, state 1), hind tibia with one seta on posterodorsal surface (Character 49, state 1), and sternite 5 with developed projections on lateral apex (Character 54, state 2). Couri and Pont (2000), based on the arrangement of the katepisternal setae (1+1+1), transferred the genus to Limnophorini. In our analysis the genus is in a polytomy with the Limnophorini and Coenosiini (sensu de Carvalho et al., 2005).

Clade H (Fig. 2. Part F**)** is formed by Limnophorini (sensu de Carvalho et al., 2005), here represented by *Tetramerinx* Berg, 1898, *Lispoides* Malloch, 1920, *Thaumasiochaeta* Stein, 1911, *Limnophora* Robineau-Desvoidy, 1830, *Syllimnophora* Speiser, 1923, *Heliographa* Malloch, 1921, and *Albertinella* Couri & Carvalho, 1997. This clade is supported by one synapomorphy and two homoplastic synapomorphies, respectively: hypoproct elongate with spines (Character 72, state 1), eyes bare (Character 6, state 0) and female segment 8 straight (Character 69, state 1). De Carvalho (1989) proposed to divide Coenosiinae into two tribes, Limnophorini and Coenosiini. This close relationship was proposed by Couri and de Carvalho (2003), Kutty et al. (2010, 2014), and Haseyama et al. (2014). On the other hand, Schuehli et al., (2007) failed to recover this close relationship. Most of those studies recovered a paraphyletic Limnophorini (Kutty et al., 2014; Haseyama et al., 2014). The relationships between the Limnophorini genera remains obscure. Many are most likely paraphyletic. Most of the studies involving them did not include enough representatives within the tribe. Our analysis revealed a close relationship between *Tetramerinx, Lispoides*, and *Thaumasiochaeta*. This clade is based on seven homoplastic synapomorphies. These genera were recovered as sister-group of the *Limnophora*,

Syllimnophora, *Heliographa* and *Albertinella*. *Limnophora* is recovered as paraphyletic in relation with *Syllimnophora*, *Heliographa* and *Albertinella.*

Clade I (Fig. 2. Part G**)** is composed of Coenosiini (sensu de Carvalho et al., 2005), represented in our data by *Rhabdotoptera* Stein, 1919, *Macrorchis* Rondani, 1877, *Agenamyia* Albuquerque, 1953, *Reynoldsia* Malloch, 1934, *Notoschoenomyza* Malloch, 1934, *Apsil* Malloch, 1929, *Bithoracochaeta* Stein, 1911, *Stomopogon* Malloch, 1930, *Coenosia* Meigen, 1926, *Cordiluroides* Albuquerque, 1954, *Altimyia* Couri, 2008, *Tapantiomyia* Michelsen, 2017, New genus Fogaça et al., 2019 (in press), *Pilispina* Albuquerque, 1954, and *Palpilongus* Couri and de Carvalho, 2013. Coenosiini is the only tribe recovered as monophyletic in almost previous studies (Hennig, 1965; Skidmore, 1985; de Carvalho, 1989; Couri and Pont, 2000; Couri and de Carvalho, 2003; Kutty et al., 2010, 2014). The relationship among the Coenosiini was studied by Couri and Pont (2000). Our results agree with Couri and Pont (2000), that there is a close relationship among *Reynoldsia*, *Notoschoenomyza* and *Apsil*. All Coenosiini represented in our study, except for new genera described after 2000, are in the apical polytomy in Couri and Pont (2000). However, in our study we recovered the close relationship among *Bithoracochaeta*, *Stomopogon* and *Coenosia* supported by one synapomorphy hypoproct height three times larger than wide (Character 73, state 1). *Cordiluroides* is paraphyletic in this analysis, and emerges as the sister group of the *Altimyia*, *Tapantiomyia* and New genus, which form a sister-group of the *Pilispina*, *Palpilongus, Cordiluroides* sp. 1 *and Cordiluroides* sp. 2*,* this clade is supported by one synapomorphy: apical scutellar setae shorter than basal apical setae (Character 32, state 1).

Concluding remarks

Ours results represents the most comprehensive study in Mydaeinae, under morphological evidence, an important step towards the understanding of the relationship

between the genera of the subfamily. The phylogenetic analysis corroborated the monophyly of Mydaeinae and of most genera analyzed. The traditional Coenosiini tribe recovered as a monophyletic group indicates that studies based on morphological evidence are necessary to better understand the relationships of subordinate groups in Muscidae. The use of Characters from immature stages, as well as biology, along with increased proportionality within genera may be the focus of the next studies.

TABLE 1. Examined material (part 1/3) Nº. Genera number; Gp. Group = In. Ingroup, Ou. Outgroup.

N°	Gp	Species / Author	Data from label or literature	Institution	Distribution
1	*In*	***Agenamyia exotica*** Carvalho & Couri, 1992	Panama, Canal Zone, 2♂	DZUP	*Neotropical*
2	*In*	***Albertinellla nebulicola*** Couri & Carvalho, 1995	Amazonas, Pico da Neblina, 8-12. x. 1990, 2♂, 1♀	DZUP	*Neotropical*
3	*In*	***Altimyia boliviana*** Couri, 2008	Bolivia, Cordillere, 4–5000 m, 24. xii. 2002, 1♂	SMT	*Neotropical*
4	*In*	***Apsil apicata*** Malloch, 1934	Argentina, T. Rio Negro, 18-25. xi. 1926, F & M Edwards Holotype 1♂, Allotype, same data a holotype,1♀	BMHN	*Neotropical*
5	*In*	***Apsil atripes*** Malloch, 1934	Chile, Concepcion, 26-28. xii. 1926 F & M Edwards, Holotype 1♂, Allotype, same data as holotype,1♀	BMHN	*Neotropical*
6	*In*	***Apsil maculiventris*** Malloch, 1929	1♂, Couri 2000b		*Neotropical*
7	*Ou*	***Arthurella choelensis***	*Patitucci et al. 2011*		
8	*Ou*	***Biopyrellia bipuncta*** Wiedemann, 1830	Mexico, 1 ♂, Colombia, xii.1914, 1 ♀	BMNH	*Neotropical*
9		***Bithoracochaeta annulata*** Stein, 1911	Peru, Laristhal,1♀, 1♂ (Couri & Motta 2000)	SMT	*Neotropical*
10	*In*	***Bithoracochaeta leucoprocta*** (Wiedemann, 1830)	Brazil, Sello leg., 5♀, Uruguai: Montevidéu, Sello leg., 4♂, 1♀, Cuba: Havana, Baker, 2♂	ZMHU	*Neotropical*
11	*In*	***Brontaea ascendens*** (Stein, 1915)	Taiwan: Kankau, Formosa, 1912, H. Sauter leg., Syntypes 3♂ 3♀, ZMHU, Pont & Werner 2006	ZMHU	*Oriental*
12	*In*	***Brontaea eremophila*** (Brauer & Bergenstamm, 1894)	Mexico, Oaxaca, Crawford, 1♂	ZMHU	*Palearctic*
13	*In*	***Brontaea normata*** (Bigot, 1885)	Brazil, Sello, 1♂, Mexico, Oaxaca, Crawford leg., 3♂. Argentina, Cordoba, Crawford leg., 1♂. Bolivia, Mapiri, 3000m, 6. v. 1903, 1♂. Colombia, Cordillera, Tierra Caliente, Thieme S. leg., 3♂	ZMHU	*Neotropical*
14	*In*	***Cordiluroides bistriata*** Wulp, 1896	St. vicent, H. H. Smith, 1907, 1♂	BMNH	*Neotropical*
15	*In*	***Coenosia acuticornis*** Stein, 1910	1♂	ZMHU	*Palearctic*
16	*In*	***Coenosia albicornis*** Meigen, 1926	1♂	ZMHU	*Australian*
17	*In*	***Coenosia attenuata*** Stein, 1903	2♂	ZMHU	*Neotropical*
18	*In*	***Cordiluroides bistriata*** Wulp, 1896	Costa Rica, 1 ♂, Couri et al, 2006	-	*Neotropical*
19	*In*	***Cordiluroides insulares*** Williston, 1896	St. Vicent, W. I., W. Indies, 1907 – 68 1♂	BMNH	*Neotropical*
20	*In*	***Cordiluroides Sp. 1***	Peru, Cuzco, 2905m, 1-12. vi. 2012, 2 ♂	DZUP	*Neotropical*
21	*In*	***Cordiluroides Sp. 2***	Peru, Cuzco, 2905m, 1-12. vi. 2012, 2 ♂	DZUP	*Neotropical*
22	*In*	***Cyrtoneurina uber*** Giglio-Tos, 1893	Brazil, Amazonas, 23-26. ix. 2010, Grisales, Guedes & Haseyama,1♀	DZUP	*Neotropical*
23	*In*	***Dolichophaonia brasiliensis*** Albuquerque, 1958	Brazil, Mato Grosso, 1♀, Rio de Janeiro, 1 ♂	DZUP/ MNRJ	*Neotropical*
24	*In*	***Dolichophaonia femorata*** Stein, 1911	Chile, Pinares,20.ix.1970, 1♀. Santiago, x. 1969, 1♂	DZUP	*Neotropical*
25	*In*	***Dolichophaonia machadoi*** Albuquerque, 1958	Brazil, Paraná, Antonina, 21.ix.1987, 1♀. Ponta Grossa, 08.xi.1999♂	DZUP	*Neotropical*
26	*In*	***Graphomya analis*** Macquart, 1851	Brazil, Rio de Janeiro, 1♂, 1♀	DZUP	*Neotropical*
27	*In*	***Graphomya maculata*** Scopoli, 1763	England, Norfolk, 24-25. viii. 1992, C. J. B. Carvalho (2♂ 1♀	DZUP)	*Palearctic*
28	*In*	***Hebcnema fumosa*** (Meigen 1826)	Krosika, V. 1907. Samnil A. Kuntze, 1♂	SMT	*Palearctic*
29	*In*	***Hebecnema nigra*** (Robineau-Desvoidy, 1830)	Berlim, Oldenberg, 1911- 3, 2♂	SMT	*Palearctic*

TABLE 1. EXAMINED MATERIAL (CONTINUATION, PART 2/3)**.** Nº. Genera number; Gp. Group = In. Ingroup, Ou. Outgroup.

N°	Gp	Species / Author	Data from label or literature	Institution	Distribution
30	***In***	***Hebecnema nigrithorax*** (Stein, 1900)	"Asatobia", x. 07, 1♂	ZMHU	*Oriental*
31	***In***	***Hebecnema vespertina*** (Fallén, 1823)	Alemanha, Frankfut, Oder, M. P. Riedel leg., 2♂, 2♀, Italia, Tr. Alto Adige, Südtirol, Glurnser Alm nr Joch Southwest of Trafoi, 2.315m, 29. vi. -4. Vii. 2005, C. Lange & J. Ziegler leg., 1♂, 1♀,	ZMHU/ SMT	*Palearctic*
32	***In***	***Helina araucana*** Patitucci et al, 2016	Argentina, Patitucci et al. 2016	Literature	*Neotropical*
33	***In***	***Helina australis*** Carvalho & Pont 1993	Argentina, Patitucci et al. 2016	Literature	*Neotropical*
34	***In***	***Helina bigoti*** Malloch, 1934	Chile, Santigo, 17-19. xi. 1926	BMHN	*Neotropical*
35	***In***	***Helina chilensis*** *Malloch, 1934*	Argentina, Patitucci et al. 2016	Literature	*Neotropical*
36	***In***	***Heliographa insignis*** (Stein, 1900)	Formosa, Sauer, Taihorin, vii. 1911, 1♂	ZMHU	*Australian*
37	***In***	***Heliographa javana*** (Macquart, 1851)	E. Jacobson. Goenoeng Oengaran Java, ix. 1910, 1♂	ZMHU	*Oriental*
38	***In***	***Heliographa procellaria*** Walker, 1858	New Guinea, Lerentz, x. 1910, 1♂	ZMHU	*Australian*
39	***In***	***Limnophora alacris*** Stein, 1911	Bolivia, Sorata, 21. xii. 02, 1♂	SMT	*Neotropical*
40	***In***	***Limnophora barbitarsis*** Stein, 1911	Bolivia, Mapiri, Lorenzopata, 2000m 7. v. 03, 1♂	SMT	*Neotropical*
41	***In***	***Limnophora iniqua*** Stein, 1911	Chile, Valparaiso, 12. ix. 02, 1♂; Arica, 10. x. 02, 1♀	SMT	*Neotropical*
42	***In***	***Limnophora marginipennis*** Stein, 1911	Peru, Pichis-Weg, 1. i. 04, 1♀	SMT	*Neotropical*
43	***In***	***Syllimnophora pauciseta*** Stein, 1904	Peru, 1♀; 1♂	SMT	*Neotropical*
44	***In***	***Lispe albitarsis*** Stein, 1898	Tifton, Ga. 1♂	ZMHU	*Nearctic*
45	***In***	***Lispe ambigua*** Stein, 1913 Afr	Abyssinia Kovacs, 1♂	ZMHU	*Afrotropical*
46	***In***	***Lispe barbipes*** Stein, 1908	Stellub 1888, 1♂	ZMHU	*Afrotropical*
47	***In***	***Lispe bengalensis*** (Robineau-Desvoidy, 1830)	Anpig, Formosa, Sauter, x. 08, 1♂	ZMHU	*Afrotropical*
48	***In***	***Lispe bivittata*** Stein, 1909 Pal	Formosa Sauter, Tainan 1912. iv,1♂	ZMHU	*Afrotropical*
49	***In***	***Lispe nasoni*** Stein, 1898	United States, Algonquin,15. Viii. 1895	ZMHU	*Nearctic*
50	***In***	***Lispoides gracilis*** Stein, 1911	Chile, Palca, 20. x. 02, 1♂; Bolivia, Sorata, 2300, 21. xii. 02, 1♂	SMT	*Neotropical*
51	***In***	***Lispoides nigribasis*** Stein, 1911	Peru, Arequipa, 3. xi. 02 1♂	SMT	*Neotropical*
52	***In***	***Lispoides pubiceps*** Stein, 1911	Bolivia, Titicaca, 30. v. 03; 3. vi. 03, 2♂; Chile, Palca, 18. x. 02, 1♂	SMT	*Neotropical*
53	***In***	***Macrorchis ausoba*** (Walker, 1849)	Canada, Toronto, Ontario, 13. iii. 1996, 1♂	ZMHU	*Nearctic*
54	***In***	***Macrorchis majuscula*** Coquillett, 1904	Pacific Grove, Cal. v. 7, 1♂	ZMHU	*Nearctic*
55	***In***	***Macrorchis meditata*** (Fallen, 1825)	Missil,1♂	ZMHU	*Nearctic*
56	***Ou***	***Muscina stabulans*** Fallén, 1817	2♂	ZMHU	*Palearctic*
57	***In***	***Mydaea nubila*** *Stein, 1916*	2♂	ZMHU	*Palearctic*
58	***In***	***Mydaea rufinervis*** Pokorny, 1889	2♂	ZMHU	*Palearctic*
59	***In***	***Mydaea urbana*** (Meigen, 1826)	2♂	ZMHU	*Palearctic*
60	***In***	***Myospila argentata*** (Walker, 1856)	E Jacobson Batavia Java, Maart, 1908, 1♂	ZMHU	*Oriental*
61	***In***	***Myospila meditabunda*** Fabricius, 1781	Argentina, 5-18. ii. 1957, 1♂	DZUP	*Neotropical*
62	***In***	***Neolimnophora maritima*** Röder, 1887	Borkum 10. Vii. 01, 1♂	SMT	*Palearctic*
63	***In***	***Neolimnophora virgo*** Villeneuve, 1906	Borkum, 22. vii. 01; 21. Vii. 01, 2 ♂	SMT	*Palearctic*
64	***Ou***	***Neomuscina currani*** Snyder, 1949			
65	***In***	***New Genus***	Colombia, Sumapaz	IAvH	
66	***In***	***Notoschoenomyza annulata*** Stein, 1911	Peru, Chanchamayo, 11. i. 04, 1♂	SMT	
67	***In***	***Notoschoenomyza spinicosta*** Stein, 1904	Peru, Puno, Titicaca, 22. xi. 02, Bolivia 29. v. 03, 1♂	SMT	*Neotropical*
68	***In***	***Ocypodomyia africana*** Pont, 2006	Senegal, 4. x. 1961, Paratype, 1♂	MNHN	*Afrotropical*

TABLE 1. EXAMINED MATERIAL (CONTINUATION, PART 3/3). Nº. Genera number; Gp. Group = In. Ingroup, Ou. Outgroup.

N°	Gp	Species / Author	Data from label or literature	Institution	Distribution
69	***In***	***Pachyceramyia cordiluroides*** (Stein,1898)	Wods Hole, Mass, ♂	ZMHU	*Nearctic*
70	***In***	***Pachyceramyia robusta*** Stein, 1920	1♂	ZMHU	*Nearctic*
71	***In***	***Palpilongus bifurcus*** Couri & de Carvalho, 2013	Costa Rica, 1♂ Couri & de Carvalho, 2013	Literature	*Neotropical*
72	***In***	***Phaonia caesiipollinosa*** Xue et al.	China, 1♂, Xue et al. 2014		*Oriental*
73	***In***	***Phaonia californiensis*** Malloch, 1923	2♂	DZUP	*Neotropical*
74	***In***	***Phaonia equatorialis*** Coelho, 1997	Ecuador, 15. iii. 1965, 1♂,1♀	DZUP	*Neotropical*
75	***In***	***Phaonia quercus*** Coelho, 1997	Peru, 1-15. x. 1962,1♂,1♀	Literature	*Neotropical*
76	***Ou***	***Philornis albuquerquei*** Couri 1983	Peru, 1♂, Couri 1983	Literature	*Neotropical*
77	***In***	***Pilispina benevenuta*** Albuquerque, 1957	Brazil, São Paulo, 2100m, v. 1951, 1♂	MNRJ	*Neotropical*
78	***In***	***Pilispina pilitibia*** Albuquerque, 1954	Brazil, Itatiaia, 2000m, ii. 1941	MNRJ	*Neotropical*
79	***Ou***	***Polietina prima*** Couri & Machado, 1990	Brazil, Rio de Janeiro, 1♂	DZUP	*Neotropical*
80	***In***	***Reynoldsia robusta*** Stein, 1911	Chile, Corral, 08. ix. 02, 1♂	SMT	*Neotropical*
81	***In***	***Rhabdotoptera striatipennis*** Stein, 1911	Peru, Oroya, 4000, 21. i. 04, 1♂	SMT	*Neotropical*
82	***In***	*Souzalopesmyia amazonica* Albuquerque, 1951	Brazil, Manaus, 1♂ Albuquerque, 1951	DZUP	*Neotropical*
83	***In***	*Souzalopesmyia paraensis* Carvalho, 1999	Peru, 12-25. i. 2014.1♂ de Carvalho, 1999	Literature	*Neotropical*
84	***In***	***Souzalopesmyia polleti*** *Gomes & de Carvalho 2018*	Guyane Française, 306 m, 6.iii.2015-10.iii.2015,1♂	DZUP	*Neotropical*
85	***In***	***Spilogona atricans*** (Pandelle, 1899)	Reinerz vi. 28, Riedel, 1♂	ZMHU	*Palearctic*
86	***In***	***Spilogona baltica*** (Ringdahl, 1918)	Riedel Rügenw, 1♂	ZMHU	*Palearctic*
87	***In***	***Spilogona carbonella*** (Zetterstedt, 1845)	1♂	ZMHU	
88	***In***	***Spilogona denigrata*** (Meigen, 1826)	2♂	DZUP	
89	***In***	***Stomopogon albiseta*** Stein, 1911	Bolivia, Titicaca, 02. vi. 03, 2♂	SMT	*Neotropical*
90	***In***	***Stomopogon capribarba*** Stein, 1911	Bolivia, 21. xii. 02, Sorata 2300m, 1♂, 2♀	SMT	*Neotropical*
91	***In***	***Stomopogon hirtitibia*** Stein, 1911	Chile, Palca, 17. x. 02, 1♂, 2♀	SMT	*Neotropical*
92	***Ou***	***Stomoxys calcitrans****, Linnaeus, 1758*	Brazil, Rio do Sul, 12. ii. 2012 1♂, 1♀	DZUP	*Neotropical*
93	***In***	***Syllimnophora aliena*** Stein, 1911	Chile, Sicuani, 19.vi.03, 2♀; Palca, 15. x. 02, 1♂	SMT	*Neotropical*
94	***In***	***Syllimnophora atrovittata*** Stein, 1904	Chile, Palca, 20. x. 01, 1♂; Bolivia, 4-5000m, 24. xii. 02, 1♀	SMT	*Neotropical*
95	***In***	***Syllimnophora candidifrons*** Stein, 1911	Bolivia, Tititcaca, 1911-3 (Schnuse), 1♂; 10. vi. 03, 1♀	SMT	*Neotropical*
96	***In***	***Syllimnophora clavitibia*** Stein, 1911	Peru, Puno, Titicaca 18. xi. 02, 1♂;29. v. 03 1♀	SMT	*Neotropical*
97	***In***	***Tapantiomyia enigmática*** Michelsen, 2017	Costa Rica, Tapantí. 2-9. xii. 2012, 1♂	ZADBI	*Neotropical*
98	***In***	***Tetramerinx inermis*** Stein, 1920	1♂	ZMHB	*Neotropical*
99	***In***	***Tetramerinx nigripes*** Stein, 1911	Chile, Arica, 12. X. 02, 2♂	SMT	*Neotropical*
100	***In***	***Tetramerinx rufitibia*** Stein, 1911	1♂	ZMHB	*Neotropical*
101	***In***	***Thaumasiochaeta compressitarsis*** Stein, 911	Peru, Laristhal 1♂, 08. Viii.03, and Schnuse, 1♂, 2♀	SMT	*Neotropical*
102	***In***	***Thaumasiochaeta nigriceps*** Stein, 1911	Peru, Oraya, 2♂, 2♀, 21. i. 04	SMT	*Neotropical*
103	***In***	***Thaumasiochaeta pilitarsis*** Stein, 1911	, Peru, Puno, 17. xi. 02, 1♂	SMT	*Neotropical*
104	***In***	***Thaumasiochaeta variegata*** Stein, 1911	Peru, Puno, 23. xi. 022♂, 2♀	SMT	*Neotropical*
105	***In***	***Villeneuvia aestuum*** Villeneuve, 1902	Omonville – Ld Rogue, 1899, Holotype, 1♂	MNHN	*Afrotropical*
106	***In***	***Xenomyia atra*** Malloch, 1921	Afrique or. Anglaise, Kenya, 2400m, i/ii. 1912, Holotype,1♂	MNHN	*Afrotropical*

Figures

Figure 1. Phylogenetic hypotheses using morphological evidence under parsimony analysis with implied weighting with $k = 18.6133$.

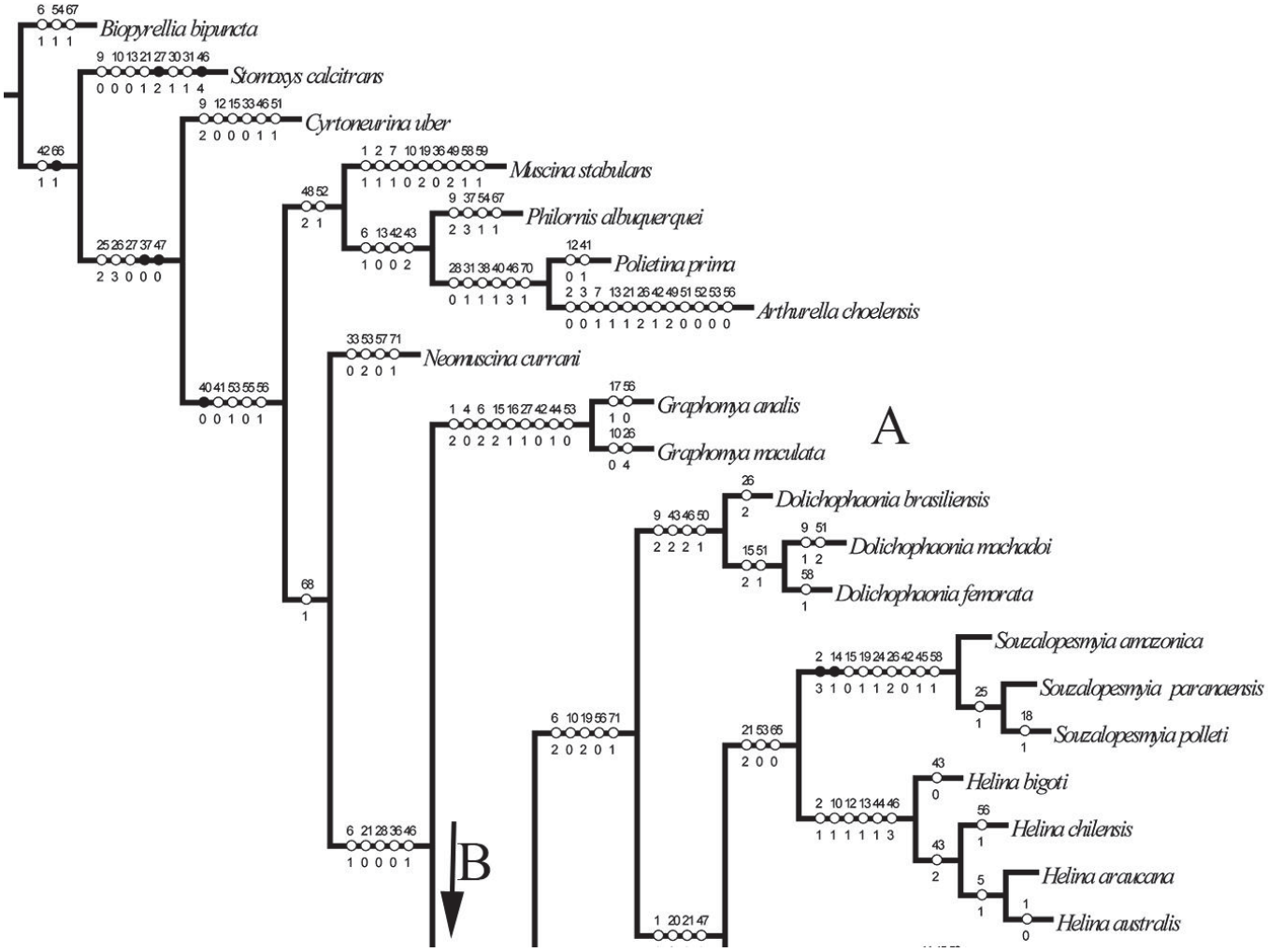

Figure 2. Part A. Phylogenetic hypotheses using morphological evidence under parsimony analysis with implied weighting with $k = 18.6133$.

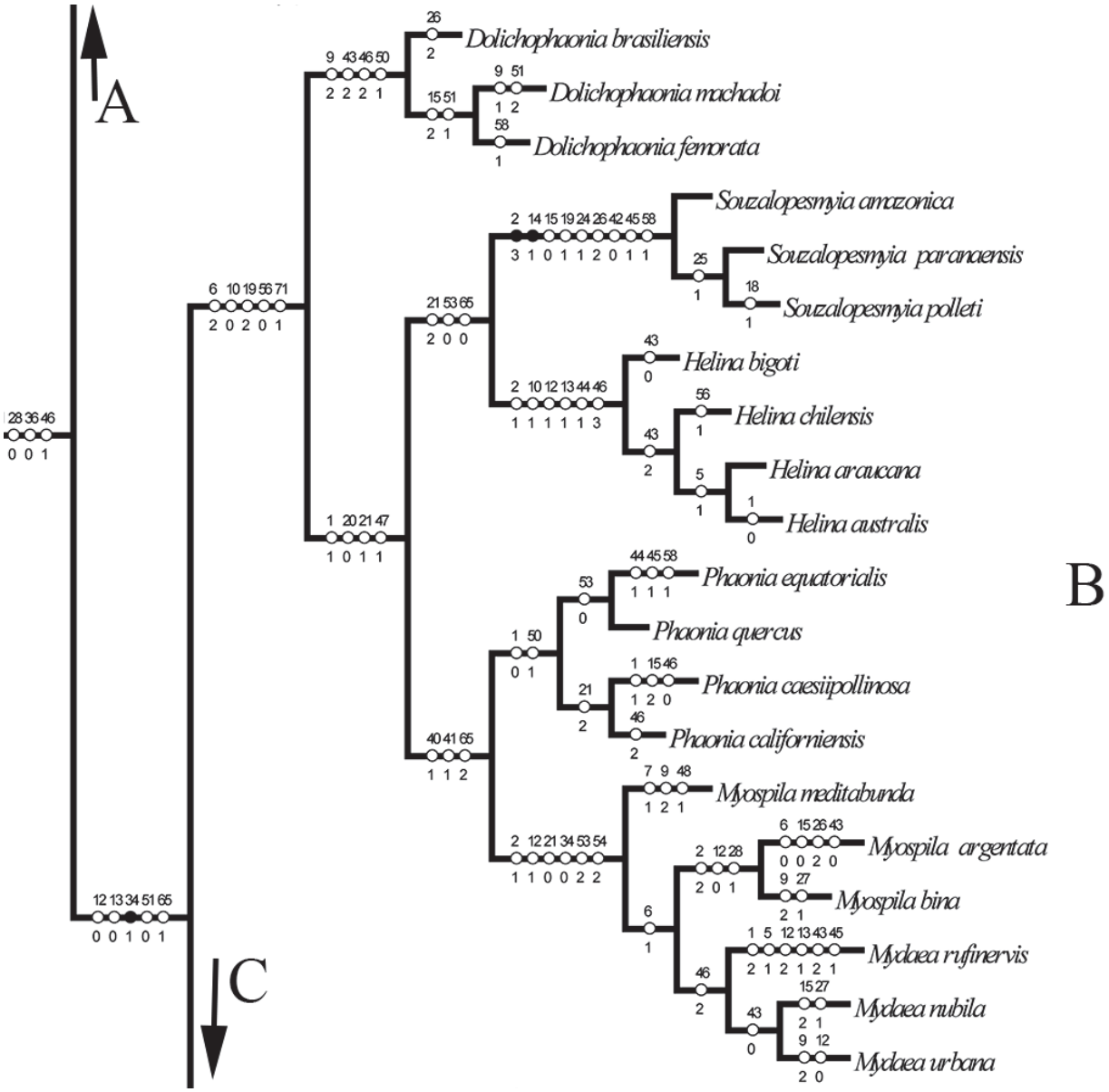

Figure 2. Part B. Phylogenetic hypotheses using morphological evidence under parsimony analysis with implied weighting with $k = 18.6133$.

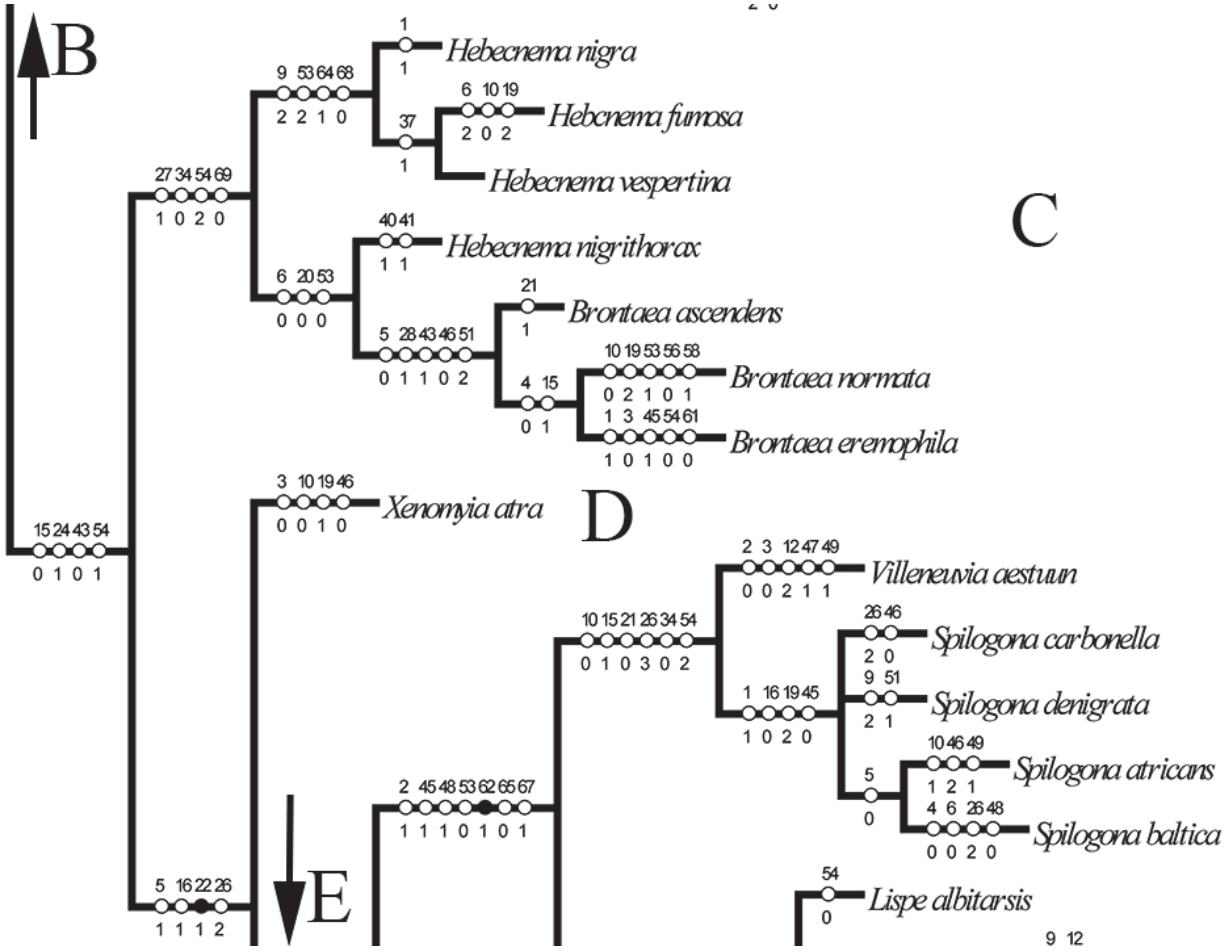

Figure 2. Parts C. Phylogenetic hypotheses using morphological evidence under parsimony analysis with implied weighting with $k = 18.6133$.

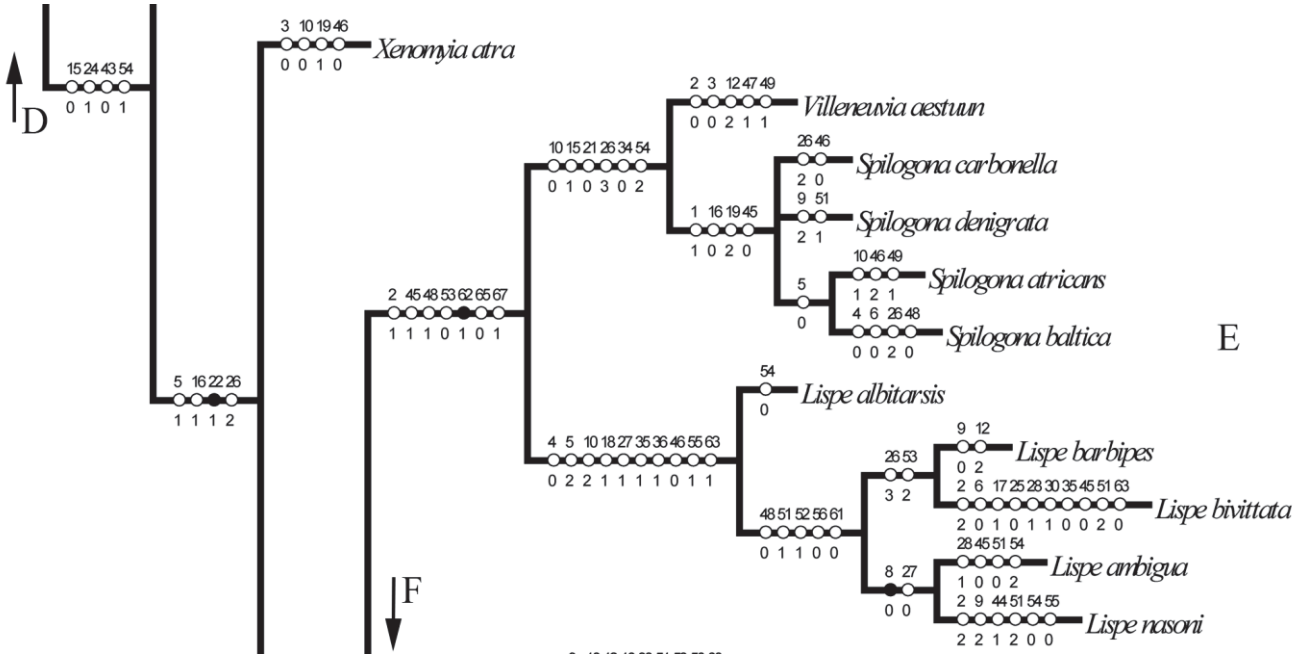

Figure 2. Part D. Phylogenetic hypotheses using morphological evidence under parsimony analysis with implied weighting with $k = 18.6133$.

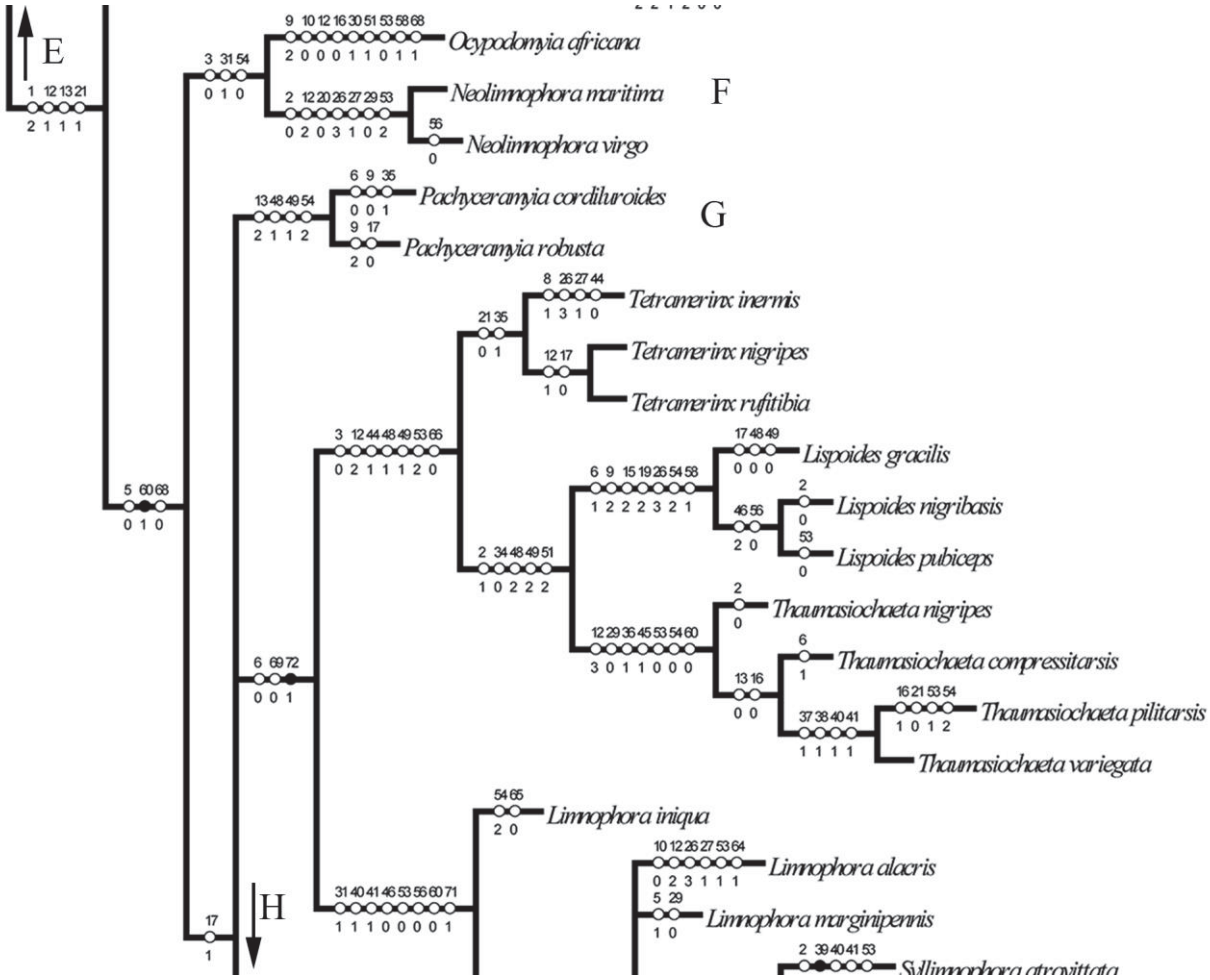

Figure 2. Part E. Phylogenetic hypotheses using morphological evidence under parsimony analysis with implied weighting with $k = 18.6133$.

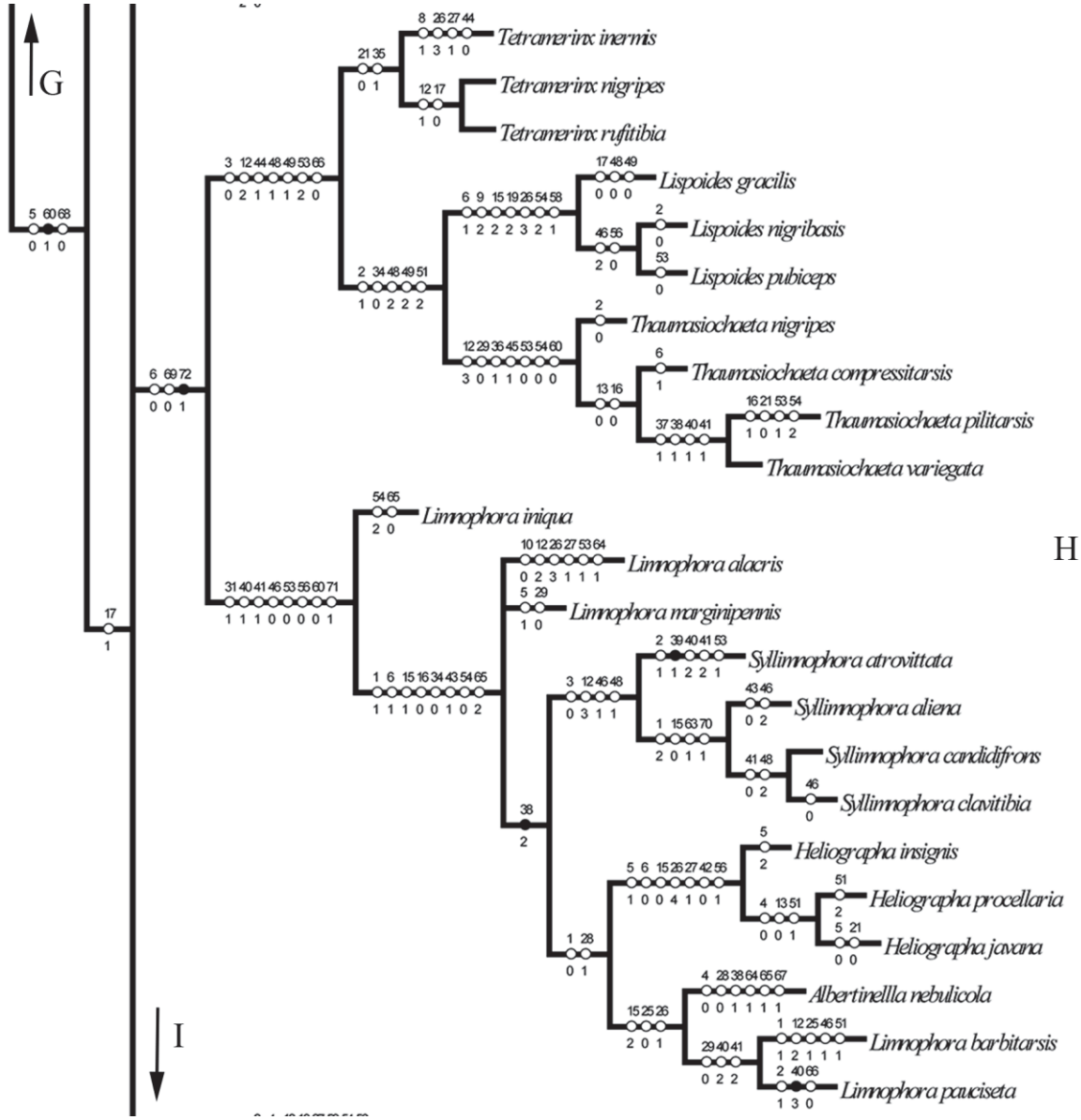

Figure 2. Part F. Phylogenetic hypotheses using morphological evidence under parsimony analysis with implied weighting with $k = 18.6133$.

Figure 2. Part G. Phylogenetic hypotheses using morphological evidence under parsimony analysis with implied weighting with $k = 18.6133$.

S1- CHARACTERS LIST

1. Head of male, frontal view, distance between eyes (modified from Barbosa 2010):

   (0) null;

   (1) smaller than ocellar triangle;

   (2) larger than ocellar triangle.

2. Antenna and postpedicel (size relationship):

   (0) similar;

   (1) larger;

   (2) 2 times larger;

   (3) More than 2 times larger.

3. Antenna, arista, setae coverage (Barbosa 2010):

   (0) Absent;

   (1) present.

4. Antenna, arista, position of microtrichia:

   (0) Only on basal half;

   (1) Entirely covered with hair.

5. Antenna, arista, development of microtrichia (modified from Barbosa 2010):

   (0) micropubscent;

   (1) pubscent;

   (2) plumose.

6. Eyes, coverage:

   (0) bare;

   (1) sparsely ciliated;

   (2) very ciliated.

7. Female, frons, interfrontal setae:

   (0) not developed;

(1) developed.

8. Female, frons, width /height ratio (modified from Barbosa 2010):

   (0) wider than long;

   (1) as wide as long;

   (2) longer than wide.

9. Palpus/ prementum ratio:

   (0) half;

   (1) similar;

   (2) larger.

10. Palpus, lateral view, shape (modified from Barbosa 2010):

    (0) filiform;

    (1) filiform, with apical half a little dilated;

    (2) spatulate.

11. Male, frons, size of ocellar triangle (modified from Barbosa 2010):

    (0) Short, not reaching half of frons;

    (1) Long, reaching or nearly reaching lunule.

12. Head, gena, lateral view, horizontal direction (modified from Barbosa 2010):

    (0) Not well developed;

    (1) developed;

    (2) very developed;

    (3) projected.

13. Head, gena, lateral view, vertical direction (modified from Barbosa 2010):

    (0) Not well developed;

    (1) developed;

    (2) very developed.

14. Head, frons, ocellar seta:

(0) developed;

(1) reduced or not developed.

15. Head, frons, frontal setae, number (modified from Barbosa 2010):

(0) one to five;

(1) six to ten;

(2) eleven to sixteen.

16. Head, fronto-orbital plate, coverage (modified from Barbosa 2010):

(0) bare;

(1) setulose.

17. Head, fronto-orbital plate, setulose, quantity (modified from Barbosa 2010):

(0) many setae;

(1) a few setae.

18. Head, parfacial, coverage (modified from Barbosa 2010):

(0) bare;

(1) setulose.

19. Head, proboscis, thickness (modified from Barbosa 2010:

(0) slender;

(1) wide;

(2) very wide.

20. Head, proboscis, prementum, appearance (modified from Barbosa 2010):

(0) dusted;

(1) bright.

21. Head, proboscis, labella, width in relation with prementum (modified from Barbosa 2010:

(0) 1.5 larger;

(1) Similar;

(2) 2 times larger.

22. Head, proboscis, prestomal teeth, development (Barbosa 2010):

(0) reduced;

(1) well developed.

23. Thorax, lower proepimeral seta, lateral view, direction (Couri & Pont 2000):

(0) upcurved;

(1) downcurved.

24. Thorax, prealar seta, development (Couri & Pont 2000):

(0) well developed;

(1) reduced.

25. Thorax, presutural dorsocentral setae, number (modified from Couri & Pont 2000):

(0) zero;

(1) one;

(2) two.

26. Thorax, postsutural dorsocentral setae, number (modified from Barbosa 2010:

(0) two;

(1) three;

(2) four;

(3) five.

27. Thorax, presutural dorsocentral setae, development (modified from Barbosa 2010):

(0) all developed;

(1) half developed;

(2) all reduced.

28. Thorax, anterior intra-alar postsutural seta, development (Couri & Pont 2000):

(0) developed;

(1) reduced.

29. Thorax, posterior intra-alar postsutural seta (Couri & Pont 2000):

(0) absent;

(1) present.

30. Thorax, posterior intra-alar postsutural seta, development (Couri & Pont 2000):

(0) long;

(1) reduced.

31. Thorax, prosternum, coverage:

(0) bare;

(1) setulose.

32. Thorax, scutellum, apical scutellar seta, development with relation to subbasal scutellar seta:

(0) as long;

(1) shorter than.

33. Thorax, scutellum, lateral scutellar seta, development:

(0) well developed;

(1) reduced.

34. Thorax, katepisternum, coverage:

(0) many setae;

(1) a few, almost bare.

35. Thorax, katepisternum, setae position (modified from Couri & Pont 2000):

(0) Not forming an equilateral triangle;

(1) forming an equilateral triangle.

36. Thorax, anepimeron, coverage (Barbosa 2010):

(0) bare;

(1) setulose.

37. Wing, lower calypter, length with relation the upper one (modified from Barbosa 2010):

(0) elongate, 1.5 times;

(1) similar;

(2) linear (transverse), much reduced;

(3) elongate, 2 times.

38. Wing, vein R1, dorsal, coverage, pattern (modified from Barbosa 2010):

(0) absent;

(1) setulose;

(2) setulose, only in the apical half.

39. Wing, vein R1, ventral, coverage, pattern:

(0) bare;

(1) setulose.

40. Wing, vein R, dorsal, node, coverage, pattern:

(0) bare;

(1) setulose;

(2) with hairs almost to the vein r-m;

(3) with hairs beyond to the vein r-m.

41. Wing, vein R, ventral, node, coverage, pattern:

(0) bare;

(1) setulose;

(2) with hairs almost to the vein r-m.

42. wing, anal vein, length:

(0) long almost reaching the apex;

(1) short to intermediate.

43. Wing, vein M and vein R, apex, direction (Barbosa 2010):

(0) parallel;

(1) convergent;

(2) divergent.

44. leg, fore tibia, posterior surface, seta on median third, development (modified from Couri & Pont 2000):

(0) reduced;

(1) well developed.

45. leg, fore tibia, anterior to anterodorsal surface, seta on median third, development (modified from Couri & Pont 2000):

(0) reduced;

(1) well developed.

46. leg, mid tibia, posterior surface, seta on median third, number (modified from Couri & Pont 2000):

(0) one;

(1) two;

(2) three;

(3) four or more.

47. leg, hind femur, apical half of dorsal surfaces, number (modified from Couri & Pont 2000):

(0) two;

(1) three.

48. leg, hind tibia, anterodorsal surface, setae, number (modified from Couri & Pont 2000):

(0) zero;

(1) one;

(2) two or more.

49. leg, hind tibia, posterodorsal surface, setae, number (modified from Couri & Pont 2000):

(0) zero;

(1) one;

(2) two or more.

50. leg, hind tibia, posterodorsal surface, calcar:

(0) reduced or absent;

(1) well developed.

51. Abdomen, sternite 1, coverage (modified from Barbosa 2010):

(0) bare;

(1) with a few setulae;

(2) with very setulae.

52. Male terminalia, Sternite 5, form (modified from Couri & Pont 2000):

(0) Quadrangular;

(1) Triangular.

53. Male terminalia, sternite 5, width of base with relation to the apex:

(0) similar;

(1) straighter;

(2) larger.

54. Male terminalia, sternite 5, ventral view, projections on the apex, pattern:

(0) not developed;

(1) with projection only on the middle;

(2) with projections well developed on lateral surface.

55. Male terminalia, sternite 5, setulose, pattern:

(0) over almost the entire surface;

(1) more concentrated on the lobes.

56. Male terminalia, cercus, shape (modified from Couri & Pont 2000):

(0) quadrangular;

(1) retangular.

57. Male terminalia, cercus, plate:

(0) Divided;

(1) fused.

58. Male terminalia, cercus, proximal part, form:

(0) with incisions;

(1) without incisions.

59. Male terminalia, cercus, distal part, form:

(0) with incisions;

(1) without incisions.

60. Male terminalia, hypandrium, shape:

(0) plate-like, note tubular;

(1) short tubular;

(2) moderately to elongate tubular.

61. Male terminalia, hypandrium, structure:

(0) membranous, simple;

(1) complex and with sclerotized areas.

62. Male terminalia, phallapodeme, development (modified from Couri & Pont 2000):

(0) reduced;

(1) greatly enlarged;

(2) enlarged only on the apex.

63. Male terminalia, pregonite, development:

(0) fully;

(1) reduced, absorbed into hypandrium.

64. Female terminalia, ovipositor, development (modified from Couri & Pont 2000):

(0) moderately long;

(1) short.

65. Female terminalia, tergites 6 and 7, form (modified from Couri & Pont 2000):

(0) one wide plate;

(1) two wide plates;

(2) intermediate to slender plates.

66. Female terminalia, sternite 6 and 7, microtrichia, pattern:

(0) developed;

(1) reduced.

67. Female terminalia, segment 8, spicules, development (modified from Couri & Pont 2000):

(0) well development;

(1) reduced.

68. Female terminalia, cerci (modified from Couri & Pont 2000):

(0) short and round;

(1) medium to long and slender.

69. Female terminalia, segment 8, direction (modified from Couri & Pont 2000):

(0) upwards;

(1) straight.

70. Female terminalia, segments 6 and 7, form:

(2) not fused;

(3) fused.

71. Female terminalia, hypoproct, development (modified from Couri & Pont 2000):

(0) reduced;

(1) absent;

(2) well developed.

72. Female terminalia, hypoproct, form:

(0) not modified and with setae;

(1) elongate with spines.

73. Female terminalia, hypoproct, high (modified from Couri & Pont 2000):

(0) at most twice as high as wide;

(1) height three times larger than wide.

S2- MATRIX (PART I). MATRIX OF MORPHOLOGICAL CHARACTERS OF MYDAEINAE

	1	2	3	4	5
Biopyrellia bipuncta	0 2 1 1 2 1 0 2 1 1 0 1 1 0 1 0 - 0 0 1 2 0 0 0 0 1 1 1 1 0 0 0 1 0 0 1 3 0 0 1 1 0 1 0 0 2 3 0 0 0 2 0
Agenamyia exotica	2 2 0 - - 0 0 2 1 1 - 0 0 0 0 0 ? 0 ? 1 ? 1 ? ? ? ? ? ? ? ? ? ? ? - ? 0 0 0 0 0 0 1 0 ? ? 0 1 ? ? 0 0 1
Albertinellla nebulicola	0 2 1 0 0 1 0 2 1 1 0 1 1 0 2 0 ? 0 0 1 1 1 0 1 0 1 0 0 1 0 1 0 1 0 0 0 0 1 0 1 1 1 1 0 0 0 0 0 0 0 0 0
Altimyia boliviana	1 2 1 1 0 1 1 - ? ? - 1 1 0 1 0 - - 0 1 1 1 1 1 2 2 0 0 1 1 0 0 0 1 0 0 0 0 0 0 0 0 1 0 ? ? 1 ? ? ? 0 0 0
Apsil apicata	2 1 0 - - 1 0 2 2 2 0 0 1 0 0 1 1 0 2 1 1 1 1 1 2 2 0 0 1 0 0 0 1 1 1 0 1 0 0 0 0 1 0 1 0 0 0 1 0 0 0 0
Apsil atripes	2 1 0 - - 1 0 2 2 2 0 0 1 0 0 1 1 0 2 1 1 1 1 1 2 2 0 0 1 0 0 0 1 1 1 0 1 0 0 0 0 1 0 1 0 0 0 1 0 0 0 0
Apsil maculiventris	2 0 0 - - 0 ? 2 2 2 1 0 1 0 0 1 1 0 0 1 1 1 1 1 1 2 0 0 1 0 0 0 1 0 1 0 1 0 0 0 0 1 0 1 0 0 0 1 0 0 0 0
Arthurella choelensis	0 0 0 - - 1 1 2 1 1 0 1 1 0 - 0 0 0 0 1 1 0 0 0 2 2 0 0 1 0 1 0 1 0 0 1 0 1 0 1 0 1 2 0 0 3 0 2 2 0 0 0
Bithoracochaeta annulata	2 2 1 1 1 0 0 2 0 1 0 0 0 0 0 0 - 0 0 1 1 1 1 1 1 1 1 0 1 1 1 0 0 1 1 1 0 0 0 0 0 0 1 0 1 0 0 0 0 0 0 0 0
Bithoracochaeta leucoprocta	2 1 1 1 1 1 0 2 0 1 0 0 0 0 0 0 - 0 0 1 1 1 1 1 1 1 1 0 1 1 1 0 0 1 1 0 0 0 0 0 0 0 1 0 1 0 0 0 0 0 0 0 0
Brontaea ascendens	0 2 1 1 0 0 0 2 1 1 0 0 0 0 0 0 - 0 0 0 1 0 0 1 2 3 1 1 1 0 0 0 1 0 0 0 0 0 0 0 0 1 1 0 0 0 0 0 0 0 2 ?
Brontaea eremophila	1 2 0 - - 0 - - 1 1 0 0 0 0 1 0 - 0 0 0 0 0 0 1 2 3 1 1 1 0 0 0 1 0 0 0 0 0 0 0 0 1 1 0 1 0 0 0 0 0 2 0
Brontaea normata	0 2 1 0 0 0 0 2 1 0 0 0 0 0 1 0 - 0 2 0 0 0 0 1 2 3 1 1 1 0 0 0 1 0 0 0 0 0 0 0 0 1 1 0 0 0 0 0 0 0 2 0
Coenosia acuticornis	2 2 1 1 0 1 0 2 1 1 0 0 0 0 0 0 - 0 0 1 1 1 1 1 1 2 0 0 1 0 0 0 1 1 1 0 1 0 0 0 0 1 0 0 1 0 0 0 0 0 0 1
Coenosia albicornis	2 1 1 1 0 1 0 2 1 1 0 0 0 0 0 0 - 0 0 1 1 1 1 1 1 1 2 0 0 1 0 0 0 1 1 1 0 0 0 0 0 0 1 0 0 1 0 0 0 0 0 0 1
Coenosia attenuata	2 $ 1 0 0 0 0 2 1 1 0 0 0 0 0 0 - 0 0 1 1 1 1 1 1 2 0 0 1 0 0 0 1 1 1 0 0 0 0 0 0 1 0 1 1 0 0 0 0 0 0 1
Cordiluroides bistriata	2 2 1 0 0 1 0 2 1 1 1 0 0 0 0 0 - 0 0 1 1 1 1 1 1 1 2 0 1 1 0 0 0 1 1 1 0 0 0 0 0 0 1 0 1 1 1 1 0 0 0 0 1
Cordiluroides insulares	2 2 1 1 0 1 0 2 1 1 1 0 0 0 0 0 - 0 0 1 1 1 1 1 1 1 2 0 0 1 0 0 0 1 1 1 0 0 0 0 0 0 1 0 1 1 1 1 0 0 0 0 1
Cordiluroides Sp1	2 2 1 1 0 1 0 2 1 1 1 0 0 0 0 0 - 0 0 1 1 1 1 1 1 1 2 0 0 1 1 0 1 1 1 1 0 0 0 0 0 0 1 0 1 1 0 1 1 0 0 0 1
Cordiluroides Sp2	2 2 1 1 0 1 0 2 1 1 1 0 0 0 0 0 - 0 0 1 1 1 1 1 1 1 2 0 1 1 0 0 1 1 1 1 0 0 0 0 0 0 1 0 1 1 0 1 1 0 0 0 1
Cyrtoneurina uber	0 2 1 1 2 0 0 2 2 1 0 0 ? 0 0 0 0 0 0 0 1 ? 0 0 0 2 3 0 1 1 0 0 0 0 0 0 1 0 0 0 1 1 1 1 0 0 1 0 0 0 0 1 ?
Dolichophaonia brasiliensis	0 2 1 1 2 2 0 2 2 0 0 0 0 0 1 0 - 0 2 1 0 0 0 0 2 2 0 0 1 0 0 0 1 1 0 0 0 0 0 0 0 1 2 0 0 2 0 0 0 1 0 0
Dolichophaonia femorata	0 2 1 1 2 2 0 2 2 0 0 0 0 0 2 0 - 0 2 1 0 0 0 0 2 3 0 0 1 0 0 0 1 1 0 0 0 0 0 0 0 1 2 0 0 2 0 0 0 1 1 0
Dolichophaonia machadoi	0 2 1 1 2 2 0 2 1 0 0 0 0 0 - 0 - 0 2 1 0 0 0 0 2 3 0 0 1 0 0 0 1 1 0 0 0 0 0 0 0 1 2 0 0 2 0 0 0 1 2 0
Graphomya analis	2 2 1 0 2 2 0 2 1 1 0 1 1 0 2 1 1 0 0 1 0 0 ? 0 2 3 1 0 1 0 0 0 1 0 0 0 0 0 0 0 0 0 1 1 0 1 0 0 0 0 2 0
Graphomya maculata	2 2 1 0 2 2 0 2 1 0 0 1 1 0 2 1 0 0 0 1 0 0 ? 0 2 4 1 0 1 0 0 0 1 0 0 0 0 0 0 0 0 0 1 1 0 1 0 0 0 0 2 0
Hebcnema fumosa	0 2 1 1 2 2 0 2 2 0 0 0 0 0 0 0 ? 0 2 1 0 0 0 1 2 3 1 0 1 0 0 0 1 0 0 0 1 0 0 0 1 0 0 0 1 0 0 0 0 0 0 0
Hebecnema nigra	1 2 1 1 2 1 0 2 2 1 0 0 0 0 0 0 - 0 0 1 0 0 0 1 2 3 1 0 1 0 0 0 1 0 0 0 0 0 0 0 0 1 0 0 0 1 0 0 0 0 0 0
Hebecnema nigrithorax	0 2 1 1 2 0 0 2 1 1 0 0 0 0 0 0 - 0 0 0 0 0 0 1 2 3 1 0 1 0 0 0 1 0 0 0 0 0 0 1 1 1 0 0 0 1 0 0 0 0 0 0
Hebecnema vespertina	0 2 1 1 2 1 0 2 2 1 0 0 0 0 0 0 - 0 0 1 0 0 0 1 2 3 1 0 1 0 0 0 1 0 0 0 1 0 0 0 1 0 0 0 1 0 0 0 0 0 0 0
Helina araucana	1 1 1 1 1 2 0 2 1 1 0 1 1 0 1 0 - 0 2 0 2 0 ? 0 2 3 0 0 1 0 0 0 1 1 0 0 0 0 0 0 0 1 2 1 0 3 ? ? ? 0 0 0

S2- MATRIX (PART II). MATRIX OF MORPHOLOGICAL CHARACTERS OF MYDAEINAE

	1	2	3	4	5
Helina australis	0 1 1 1 1 2 0 2 1 1 0 1 1 0 1 0 - 0 2 0 2 0 ? 0 2 3 0 0 1 0 0 0 1 1 0 0 0 0 0 0 0 1 2 1 0 3 ? ? ? 0 0 0
Helina bigoti	1 1 1 1 1 2 2 0 2 1 1 0 1 1 0 1 0 - 0 2 0 2 0 ? 0 2 3 0 0 1 0 0 0 1 1 0 0 0 0 0 0 0 1 0 1 0 3 ? ? ? 0 0 0
Helina chilensis	1 1 1 1 1 2 2 0 2 1 1 0 1 1 0 1 0 - 0 2 0 2 0 ? 0 2 3 0 0 1 0 0 0 1 1 0 0 0 0 0 0 0 1 2 1 0 3 ? ? ? 0 0 0
Heliographa insignis	0 2 1 1 2 0 0 2 1 1 0 1 1 0 0 0 - 0 0 1 1 1 0 1 2 4 1 1 1 0 1 0 1 0 0 0 0 2 0 1 1 0 1 0 0 0 0 0 0 0 0 0
Heliographa javana	0 2 1 0 0 0 0 2 1 1 0 1 0 0 0 0 - 0 0 1 0 1 0 1 2 4 1 1 1 0 1 0 1 0 0 0 0 2 0 1 1 0 1 0 0 0 0 0 0 0 1 0
Heliographa procellaria	0 2 1 0 1 0 0 2 1 1 0 1 0 0 0 0 - 0 0 1 1 1 0 1 2 4 1 1 1 0 1 0 1 0 0 0 0 2 0 1 1 0 1 0 0 0 0 0 0 0 2 0
Limnophora alacris	1 2 1 1 0 1 0 2 1 0 0 2 1 0 1 0 - 0 0 1 1 1 0 1 2 3 1 0 1 0 1 0 1 0 0 0 0 0 0 1 1 1 1 0 0 0 0 0 0 0 0 0
Limnophora barbitarsis	1 2 1 1 0 1 - - 1 1 0 2 1 0 2 0 - 0 0 1 1 1 0 1 1 1 0 1 0 - 1 0 1 0 0 0 0 2 0 2 2 1 1 0 0 1 0 0 0 0 1 0
Limnophora iniqua	2 2 1 1 0 0 0 2 1 1 0 1 1 0 0 1 1 0 0 1 1 1 0 1 2 2 0 0 1 0 1 0 1 1 0 0 0 0 0 1 1 1 0 0 0 0 0 0 0 0 0 0
Limnophora marginipennis	- 2 1 1 1 1 0 2 1 1 0 1 1 0 ? ? - ? 0 1 1 1 0 1 2 2 0 0 0 0 1 0 1 0 0 0 0 0 0 1 1 1 1 0 0 0 0 0 0 0 0 0
Limnophora pauciseta	0 1 1 1 0 - 0 2 1 1 0 1 1 0 2 0 - 0 0 1 1 1 0 1 0 1 0 1 0 - 1 0 1 0 0 0 0 2 0 3 2 1 1 0 0 0 0 0 0 0 ?
Lispe albitarsis	2 1 1 0 2 1 0 2 1 2 0 1 1 0 0 1 0 1 0 1 1 1 0 1 2 2 1 0 1 0 0 0 1 1 1 1 0 0 0 0 0 1 0 0 1 0 0 1 0 0 0 0
Lispe ambigua	2 1 1 0 2 1 0 0 1 2 0 1 1 0 0 1 0 1 0 1 1 1 1 0 1 2 2 0 1 1 0 0 0 1 1 1 1 0 0 0 0 0 1 0 0 0 0 0 0 0 0 1
Lispe barbipes	2 1 1 0 2 1 0 2 0 2 0 2 1 0 0 1 0 1 0 1 1 1 0 1 2 3 1 0 1 0 0 0 1 1 1 1 0 0 0 0 0 1 0 0 1 0 0 0 0 0 1 1
Lispe bivittata	2 2 1 0 2 0 0 2 1 2 0 1 1 0 0 1 1 1 0 1 1 1 0 1 0 3 1 1 1 1 0 0 1 1 0 1 0 0 0 0 0 1 0 0 0 0 0 0 0 0 2 1
Lispe nasoni	2 2 1 0 2 1 0 0 2 2 0 1 1 0 0 1 0 1 - 1 1 1 0 1 2 2 0 0 1 0 0 0 1 1 1 1 0 0 0 0 0 1 0 1 1 0 0 0 0 0 2 1
Lispoides gracilis	2 1 0 - - 1 0 2 2 1 0 2 1 0 2 1 0 0 2 1 1 1 0 1 2 3 0 0 1 0 0 0 1 0 0 0 0 0 0 0 0 1 0 1 0 1 0 0 0 0 2 0
Lispoides nigribasis	2 0 0 - - 1 0 2 2 1 0 2 1 0 2 1 1 0 2 1 1 1 0 1 2 3 0 0 1 0 0 0 1 0 0 0 0 0 0 0 0 1 0 1 0 2 0 2 2 0 2 0
Lispoides pubiceps	2 1 0 - - 1 0 2 2 1 0 2 1 0 2 1 1 0 2 1 1 1 0 1 2 3 0 0 1 0 0 0 1 0 0 0 0 0 0 0 0 1 0 1 0 2 0 2 2 0 2 0
Macrorchis ausoba	2 2 1 1 1 1 0 2 1 1 0 1 0 0 0 1 1 0 2 1 1 1 1 1 2 2 0 0 1 0 0 0 1 1 0 0 0 0 0 0 0 1 0 0 1 0 1 0 0 0 0 1
Macrorchis majuscula	2 1 1 1 0 1 0 2 1 1 0 1 0 0 0 0 1 1 0 2 1 1 1 1 1 2 2 0 0 1 0 0 0 1 1 1 0 0 0 0 0 0 1 0 0 1 0 1 0 0 0 0 1
Macrorchis meditata	2 1 1 1 0 1 0 2 1 1 0 1 0 0 0 0 ? 0 2 1 1 1 1 1 2 2 0 0 1 0 0 0 1 1 1 0 0 0 0 0 0 1 0 0 1 0 1 0 0 0 0 0
Muscina stabulans	1 1 1 1 2 0 1 2 1 0 0 1 1 0 1 0 ? 0 2 1 2 0 0 0 2 3 0 1 1 0 0 0 1 0 0 0 0 0 0 0 0 0 1 1 0 0 2 0 2 2 0 2 1
Mydaea nubila	1 1 1 1 2 1 0 ? 1 0 0 1 0 0 2 0 - 0 2 0 0 0 0 0 2 3 1 0 1 0 0 0 1 0 0 0 0 0 0 0 1 1 1 0 0 0 2 1 0 0 0 0 ?
Mydaea rufinervis	2 1 1 1 1 1 0 2 1 0 0 2 1 0 1 0 - 0 2 0 0 0 0 0 2 3 0 0 1 0 0 0 1 0 0 0 0 0 0 0 1 1 1 2 0 1 2 1 0 0 0 0 ?
Mydaea urbana	1 1 1 1 2 1 0 2 2 0 0 0 0 0 1 0 - 0 2 0 0 0 0 0 0 2 3 0 0 1 0 0 0 1 0 0 0 0 0 0 0 1 1 1 0 0 0 2 1 0 0 0 0 ?
Myospila argentata	1 2 1 1 2 0 0 2 1 0 0 0 0 0 0 0 - 0 2 0 0 0 0 0 0 2 2 0 1 1 0 0 0 1 0 0 0 0 0 0 0 1 1 1 0 0 0 1 1 0 0 0 0 ?
Myospila bina	1 2 1 1 2 1 0 2 2 0 0 0 0 0 1 0 - 0 2 0 0 0 0 0 2 3 1 1 1 0 0 0 1 0 0 0 0 0 0 0 1 1 1 1 0 0 1 1 0 0 0 0 0
Myospila meditabunda	1 1 1 1 2 2 1 2 2 0 0 1 0 0 1 0 - 0 2 0 0 0 0 0 2 3 0 0 1 0 0 0 1 0 0 0 0 0 0 0 1 1 1 1 0 0 1 1 1 0 0 0 0
Neolimnophora maritima	2 0 0 - - 1 0 2 1 1 0 2 1 0 0 1 0 0 0 0 1 1 0 1 2 3 1 0 0 0 1 0 1 1 0 0 0 0 0 0 0 1 0 0 0 1 0 0 0 0 0 0
Neolimnophora virgo	2 0 0 - - 1 0 2 1 1 0 2 1 0 0 1 0 0 0 0 0 1 1 0 1 2 3 1 0 0 0 1 0 1 1 0 0 0 0 0 0 0 1 0 0 0 1 0 0 0 0 0 0
Neomuscina currani	0 2 1 1 2 0 0 2 1 1 0 1 1 0 1 0 - 0 0 1 2 0 0 0 2 3 0 1 1 0 0 0 0 0 0 1 0 0 0 0 0 1 1 0 0 2 0 0 0 0 0 2 0

S2- MATRIX (PART III). MATRIX OF MORPHOLOGICAL CHARACTERS OF MYDAEINAE

	1	2	3	4	5
New Genus	2 1 1 0 0 1 0 2 0 0 1 3 2 0 0 0 - 0 0 1 0 1 1 1 1 2 2 0 0 1 0 0 0 1 1 1 0 0 0 0 0 0 0 1 0 0 1 0 0 1 2 0 0 1
Notoschoenomyza annulata	2 1 1 0 0 1 0 1 1 2 0 0 0 0 0 0 - 0 0 0 1 1 1 1 1 2 2 0 0 0 0 0 0 1 1 1 0 1 0 0 0 0 1 0 1 0 1 0 1 1 0 0 0
Notoschoenomyza spinicosta	2 1 1 0 0 1 0 1 0 2 0 0 0 0 0 0 - 0 0 0 1 1 1 1 1 2 2 0 0 0 0 0 0 0 1 1 1 0 1 0 0 0 0 1 0 1 0 1 0 1 1 0 0 0
Ocypodomyia africana	2 2 0 - - 1 0 2 2 0 0 0 1 0 0 0 - 0 0 1 1 1 0 1 2 2 2 0 0 1 1 1 0 1 1 0 0 0 0 0 0 0 0 1 0 0 0 1 0 0 0 0 0 1 0
Pachyceramyia cordiluroides	2 2 1 1 0 0 0 2 0 - 0 1 2 0 0 1 1 0 0 1 1 1 0 1 2 2 2 0 0 1 0 0 0 1 1 1 0 0 0 0 0 0 0 1 0 0 0 1 0 1 1 0 0 0
Pachyceramyia robusta	2 2 1 1 0 1 - 2 2 1 0 1 2 0 0 1 0 0 0 1 1 1 0 1 2 2 2 0 0 1 0 0 0 1 1 0 0 0 0 0 0 0 0 1 0 0 0 1 0 1 1 0 0 ?
Palpilongus bifurcus	2 2 1 1 0 0 0 2 2 1 0 0 0 0 0 0 - 0 0 1 0 1 1 1 1 2 0 0 1 0 0 1 1 1 1 0 0 0 0 0 0 0 1 0 1 0 0 0 1 2 0 0 1
Phaonia caesiipollinosa	1 2 1 1 2 2 0 ? ? ? ? 0 0 0 2 0 - ? 2 ? 2 0 ? 0 2 3 0 0 1 0 0 0 1 1 0 0 0 0 0 0 1 1 ? 1 0 0 0 1 0 0 1 0 0
Phaonia californiensis	0 2 1 1 2 2 0 2 ? ? ? 0 0 0 1 0 - ? 2 ? 2 0 ? 0 2 3 0 0 1 0 0 0 1 1 0 0 0 0 0 0 1 1 ? 1 0 0 2 1 0 0 1 0 0
Phaonia equatorialis	0 2 1 1 2 2 0 2 ? ? ? 0 0 0 1 0 - ? 2 ? 1 0 ? 0 2 3 0 0 1 0 0 0 1 1 0 0 0 0 0 0 1 1 ? 1 1 1 1 1 0 0 1 0 0
Phaonia quercus	0 2 1 1 2 2 0 2 ? ? ? 0 0 0 1 0 - ? 2 ? 1 0 ? 0 2 3 0 0 1 0 0 0 1 1 0 0 0 0 0 0 1 1 ? 1 0 0 1 1 0 0 1 0 0
Philornis albuquerquei	0 2 1 1 2 1 0 2 2 1 0 1 0 0 1 0 - 0 0 1 2 0 0 0 2 3 0 1 1 0 0 0 1 0 0 1 3 0 0 0 0 0 2 0 0 2 0 2 0 0 2 1
Pilispina benevenuta	2 2 1 1 0 1 0 2 1 1 * 1 0 0 0 0 - 0 0 1 1 1 1 1 1 2 0 0 1 0 0 1 1 1 1 0 0 0 0 0 0 0 1 0 1 1 1 0 2 2 0 0 1
Pilispina pilitibia	2 2 1 1 0 1 0 2 1 1 1 1 0 0 0 0 - 0 0 1 1 1 1 1 1 2 0 0 1 0 0 1 1 1 1 0 0 0 0 0 0 0 1 0 1 1 0 0 2 2 0 0 1
Polietina prima	0 2 1 1 2 1 0 2 1 1 0 0 0 0 1 0 - 0 0 1 2 0 0 0 2 3 0 0 1 0 1 0 1 0 0 1 0 1 0 1 1 0 2 0 0 3 0 2 0 0 2 1
Reynoldsia robusta	2 2 1 0 0 1 - - 1 1 0 0 0 0 0 1 1 1 0 0 1 1 1 1 1 2 2 0 0 1 0 0 0 1 1 1 0 0 0 0 0 0 0 1 0 1 0 1 0 1 0 0 0 ?
Rhabdotoptera striatipennis	2 0 1 0 0 1 0 2 1 1 0 2 1 0 0 0 - 0 2 1 1 1 1 1 2 2 2 0 0 1 0 0 0 1 1 1 0 1 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0
Souzalopesmyia paranaensis	1 3 1 1 2 2 0 2 1 0 0 0 0 1 0 0 - 0 1 0 2 0 ? 1 1 2 0 0 1 0 0 0 1 1 0 0 0 0 0 0 0 0 0 1 0 1 1 1 0 0 0 0 0
Souzalopesmyia amazonica	1 3 1 1 2 2 0 2 1 0 0 0 0 1 0 0 - 0 1 0 2 0 ? 1 2 2 0 0 1 0 0 0 1 1 0 0 0 0 0 0 0 0 0 1 0 1 1 1 0 0 0 0 0
Souzalopesmyia polleti	1 3 1 1 2 2 0 2 1 0 0 0 0 1 0 0 - 1 1 0 2 0 ? 1 1 2 0 0 1 0 0 0 1 1 0 0 0 0 0 0 0 0 1 0 1 1 1 0 0 0 0 0
Spilogona atricans	1 1 1 1 0 1 0 2 1 1 0 1 1 0 1 0 - 0 2 1 0 1 0 1 2 3 0 0 1 0 0 0 1 0 0 0 0 0 0 0 0 0 1 0 0 0 2 0 1 1 0 0 0
Spilogona baltica	1 1 1 0 0 0 0 0 2 1 0 0 1 1 0 1 0 - 0 2 1 0 1 0 1 2 2 0 0 1 0 0 0 1 0 0 0 0 0 0 0 0 0 1 0 0 0 1 0 0 0 0 0 0
Spilogona carbonella	1 1 1 1 1 1 0 2 1 0 0 1 1 0 1 0 - 0 2 1 0 1 0 1 2 2 0 0 1 0 0 0 1 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 1 0 0 0 ?
Spilogona denigrata	1 1 1 1 1 1 0 2 2 0 0 1 1 0 1 0 - 0 2 1 0 1 0 1 2 3 0 0 1 0 0 0 1 0 0 0 0 0 0 0 0 0 1 0 0 0 1 0 1 0 0 1 ?
Stomopogon albiseta	2 2 1 1 0 0 ? ? 2 0 0 0 0 0 0 0 0 - 0 0 1 1 1 1 1 1 2 0 0 1 0 0 0 1 1 1 0 0 0 0 0 0 0 1 0 1 0 0 0 2 1 0 0 0
Stomopogon capribarba	2 2 1 1 0 0 0 0 2 0 0 0 1 0 0 0 0 - 0 0 1 1 1 1 1 1 2 0 0 1 0 0 0 1 1 1 0 0 0 0 0 0 0 1 0 1 0 0 0 2 1 0 0 0
Stomopogon hirtitibia	2 2 0 - - 1 0 2 1 0 0 1 1 0 0 0 - 0 0 1 1 1 1 1 1 2 0 0 1 0 0 0 1 1 1 0 0 0 0 0 0 0 1 0 1 0 0 0 2 1 0 0 ?
Stomoxys calcitrans	0 2 1 1 2 0 0 2 0 0 0 1 0 0 1 0 - 0 0 1 1 0 0 0 0 0 1 2 1 ? 1 1 0 1 0 0 1 3 0 0 1 1 1 1 0 0 4 3 0 0 0 2 ?
Syllimnophora aliena	2 2 0 - - 1 0 2 1 1 0 3 1 0 0 0 - 0 0 1 1 1 0 1 2 2 0 0 1 0 1 0 1 0 0 0 0 2 0 1 1 1 0 0 0 2 0 1 0 0 0 0
Syllimnophora atrovittata	1 1 0 ? ? 1 0 2 1 1 0 3 1 0 1 0 - 0 0 1 1 1 0 1 2 2 0 0 1 0 1 0 1 0 0 0 0 2 1 2 2 1 1 0 0 1 0 1 0 0 0 ?
Syllimnophora candidifrons	2 2 0 - - 1 0 2 1 1 0 3 1 0 0 0 - 0 0 1 1 1 0 1 2 2 0 0 1 0 1 0 1 0 0 0 0 2 0 1 0 1 1 0 0 1 0 2 0 0 0 0
Syllimnophora clavitibia	2 2 0 - - 1 0 2 1 1 0 3 1 0 0 0 - 0 0 1 1 1 0 1 2 2 0 0 1 0 1 0 1 0 0 0 0 2 0 1 0 1 1 0 0 0 0 2 0 0 0 0

S2- MATRIX (PART IV). MATRIX OF MORPHOLOGICAL CHARACTERS OF MYDAEINAE

	1	2	3	4	5
Tapantiomyia enigmatica	1 2 1 0 0 0 ? - 1 1 1 1 1 0 0 0 - - 0 1 1 1 1 1 1 2 1 1 0 - 0 0 0 1 1 0 0 0 0 0 0 0 1 0 1 ? 2 ? ? 1 0 0 ?
Tetramerinx inermis	2 2 0 - - 0 0 1 1 1 0 2 1 0 0 1 1 0 0 1 0 1 0 1 2 3 1 0 1 0 0 0 1 1 1 0 0 0 0 0 0 0 1 0 0 0 1 0 1 1 0 0 ?
Tetramerinx nigripes	2 2 0 - - 0 0 2 1 1 0 1 0 0 1 0 0 0 1 0 1 0 1 2 2 0 0 1 0 0 0 1 1 1 0 0 0 0 0 0 0 1 0 1 0 1 0 1 1 0 0 0
Tetramerinx rufitibia	2 2 0 - - 0 0 2 1 1 0 1 1 0 0 1 0 0 0 1 0 1 0 1 2 2 0 0 1 0 0 0 1 1 1 0 0 0 0 0 0 0 1 0 1 0 1 0 1 1 0 0 ?
Thaumasiochaeta compressitarsis	2 1 0 - - 1 0 2 1 1 0 3 0 0 0 0 - 0 0 1 1 1 0 1 2 2 2 0 0 0 0 0 0 0 1 0 0 1 0 0 0 0 0 0 1 0 1 1 1 0 2 2 0 2 0
Thaumasiochaeta nigripes	2 0 0 - - 0 0 2 1 1 0 3 1 0 0 1 1 0 0 1 1 1 0 1 2 2 0 0 0 0 0 0 1 0 0 1 0 0 0 0 0 1 0 1 1 1 0 2 2 0 2 0
Thaumasiochaeta pilitarsis	2 1 0 - - 0 0 2 1 1 0 3 0 0 0 1 1 0 0 1 0 1 0 1 2 2 0 0 0 0 0 0 0 1 0 0 1 1 1 0 1 1 1 0 1 1 1 0 2 2 0 2 0
Thaumasiochaeta variegata	2 1 0 - - 0 0 2 1 1 0 3 0 0 0 0 - 0 0 1 1 1 0 1 2 2 0 0 0 0 0 0 0 1 0 0 1 1 1 0 1 1 1 ? 1 1 1 0 2 2 0 - 0
Villeneuvia aestuun	2 0 0 - - 1 0 2 1 0 0 2 1 0 1 1 0 0 0 1 0 1 0 1 2 3 0 0 1 0 0 0 1 0 0 0 0 0 0 0 0 1 0 0 1 1 1 1 1 0 0 ?
Xenomyia atra	0 2 0 - - 1 - - 1 0 0 0 0 0 0 0 1 0 0 1 1 0 1 0 1 2 2 0 0 1 0 0 0 1 1 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 ?

S2- MATRIX (PART V). MATRIX OF MORPHOLOGICAL CHARACTERS OF MYDAEINAE

	6																			7		
Biopyrellia bipuncta	0	1	1	0	?	0	0	0	1	0	0	0	?	0	1	?	?	?	?	?	0	
Agenamyia exotica	0	0	1	1	1	0	0	?	?	?	?	?	1	1	0	0	1	0	0	0	0	
Albertinellla nebulicola	0	0	0	0	1	0	0	0	1	0	0	1	1	1	1	0	0	0	1	1	0	
Altimyia boliviana	0	0	0	1	1	0	0	2	1	0	0	0	2	0	0	1	1	1	1	0	0	
Apsil apicata	0	0	1	1	0	0	0	2	1	2	?	0	2	0	0	1	1	0	1	0	0	
Apsil atripes	0	0	1	1	0	0	0	2	1	2	0	0	2	0	0	1	1	0	1	0	0	
Apsil maculiventris	0	0	1	1	0	0	0	2	1	2	0	0	2	1	0	1	1	0	1	0	0	
Arthurella choelensis	0	0	0	0	1	0	0	-	1	0	0	0	2	1	0	0	1	1	0	0	0	
Bithoracochaeta annulata	0	0	0	1	1	0	?	2	0	0	0	0	2	0	0	1	1	0	1	0	1	
Bithoracochaeta leucoprocta	0	0	0	1	1	0	?	2	0	0	0	0	2	0	0	1	1	0	1	0	1	
Brontaea ascendens	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	
Brontaea eremophila	0	0	0	1	1	0	?	0	0	0	0	?	?	?	?	?	?	?	?	?	?	
Brontaea normata	1	2	0	0	1	1	0	0	1	0	0	0	?	1	0	1	0	0	?	?	?	
Coenosia acuticornis	1	2	0	1	1	0	1	2	0	0	0	?	?	?	?	?	?	?	?	?	?	
Coenosia albicornis	1	2	0	1	1	0	0	2	0	0	0	?	?	?	?	?	?	?	?	?	?	
Coenosia attenuata	1	2	0	1	1	0	0	2	0	0	0	?	?	?	?	?	?	?	?	?	?	
Cordiluroides bistriata	1	0	1	1	1	1	0	2	1	0	0	0	2	1	0	1	1	1	1	0	0	
Cordiluroides insulares	1	0	0	1	1	1	0	2	1	0	0	?	?	?	?	?	?	?	?	?	?	
Cordiluroides Sp1	0	0	1	1	1	0	0	2	1	0	0	?	?	?	?	?	?	?	?	?	?	
Cordiluroides Sp2	1	0	1	1	1	0	0	2	1	0	0	0	2	1	1	1	1	1	1	0	0	
Cyrtoneurina uber	0	0	1	0	1	0	0	0	1	0	?	0	2	?	?	0	?	0	?	?	?	
Dolichophaonia brasiliensis	1	0	0	0	1	0	0	?	1	0	0	?	1	1	0	1	1	0	1	0	0	
Dolichophaonia femorata	1	0	0	0	1	1	0	?	1	0	0	?	1	1	0	1	1	0	1	0	0	
Dolichophaonia machadoi	1	0	0	0	1	0	0	?	1	0	0	?	1	1	0	1	1	0	1	0	0	
Graphomya analis	0	0	0	0	1	0	0	0	1	0	0	0	?	?	?	1	1	?	0	0	0	
Graphomya maculata	0	0	0	1	1	0	0	0	1	0	0	0	2	1	0	1	1	0	0	0	0	
Hebcnema fumosa	2	2	0	1	1	0	?	0	1	0	?	1	?	1	0	0	0	?	0	0	?	
Hebecnema nigra	2	2	0	1	1	0	?	0	1	0	?	?	?	?	?	?	?	?	?	?	?	
Hebecnema nigrithorax	0	2	0	1	1	0	?	0	1	0	0	?	?	?	?	?	?	?	?	?	?	
Hebecnema vespertina	2	2	0	1	1	0	?	0	1	0	?	1	?	?	0	0	0	?	?	0	?	
Helina araucana	0	0	0	0	1	0	0	?	1	0	0	?	0	1	0	1	1	0	1	0	0	

S2- MATRIX (PART VI). MATRIX OF MORPHOLOGICAL CHARACTERS OF MYDAEINAE

								6									7			
Helina australis	0	0	0	0	1	0	0	?	1	0	0	?	0	1	0	1	1	0	1	0	0
Helina bigoti	0	0	0	0	1	0	0	?	1	0	0	?	0	1	0	1	1	0	1	0	0
Helina chilensis	0	0	0	1	1	0	0	?	1	0	0	?	0	1	0	1	1	?	?	0	0
Heliographa insignis	0	0	0	1	1	0	?	0	1	0	0	?	?	?	?	?	?	?	?	?	?
Heliographa javana	0	0	0	1	1	0	?	0	1	0	0	?	?	?	?	?	?	?	?	?	?
Heliographa procellaria	0	0	0	1	1	0	?	0	1	0	0	?	?	?	?	?	?	?	?	?	?
Limnophora alacris	1	0	0	0	1	0	?	0	1	0	0	1	2	1	0	0	0	0	1	1	0
Limnophora barbitarsis	0	0	0	0	1	0	?	0	1	0	0	0	2	1	0	0	0	0	1	1	0
Limnophora iniqua	0	2	0	0	1	0	?	0	1	0	0	0	0	1	0	0	0	0	1	1	0
Limnophora marginipennis	0	0	0	0	1	0	0	0	1	0	0	?	?	?	?	0	0	?	?	?	?
Limnophora pauciseta	?	0	0	0	1	0	?	0	1	0	0	0	2	0	0	0	0	0	1	1	0
Lispe albitarsis	0	0	1	1	1	0	0	0	1	1	1	?	?	?	?	?	?	?	?	?	?
Lispe ambigua	0	2	1	0	1	0	?	0	0	1	1	?	?	?	?	?	?	?	?	?	?
Lispe barbipes	2	1	1	0	1	0	?	0	0	1	1	?	?	?	?	?	?	?	?	?	?
Lispe bivittata	2	?	?	0	1	0	?	0	0	1	0	?	?	?	?	?	?	?	?	?	?
Lispe nasoni	0	0	0	?	1	0	0	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Lispoides gracilis	2	2	0	1	1	1	?	1	1	0	?	0	?	0	0	0	?	0	0	?	?
Lispoides nigribasis	2	2	0	0	1	1	?	1	1	0	0	0	?	0	0	0	?	0	0	?	?
Lispoides pubiceps	0	2	0	0	1	1	?	1	1	0	?	0	?	0	0	0	?	?	0	?	?
Macrorchis ausoba	0	2	1	1	1	1	?	2	1	0	0	?	?	?	?	?	?	?	?	?	?
Macrorchis majuscula	0	2	1	1	1	1	?	2	1	0	0	?	?	?	?	?	?	?	?	?	?
Macrorchis meditata	0	0	0	1	1	0	?	2	1	0	0	?	?	?	?	?	?	?	?	?	?
Muscina stabulans	?	0	0	1	?	1	1	0	1	0	0	?	?	?	?	?	?	?	?	?	?
Mydaea nubila	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Mydaea rufinervis	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Mydaea urbana	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Myospila argentata	?	?	?	0	1	0	?	0	1	0	0	?	?	?	?	?	?	?	?	?	?
Myospila bina	2	2	0	0	1	0	?	0	1	0	0	?	?	?	?	?	?	?	?	?	?
Myospila meditabunda	2	2	0	0	1	0	0	0	1	0	0	?	?	?	?	?	?	?	?	?	?
Neolimnophora maritima	2	0	0	1	1	0	?	1	1	0	0	0	?	1	0	0	1	?	?	?	?
Neolimnophora virgo	2	0	0	0	1	0	?	1	1	0	0	0	?	?	0	0	1	?	?	?	?
Neomuscina currani	2	0	0	1	0	0	0	?	1	0	0	0	2	1	0	1	1	0	1	0	0

S2- MATRIX (PART VII). MATRIX OF MORPHOLOGICAL CHARACTERS OF MYDAEINAE

	6															7					
New Genus	1	0	1	1	1	0	0	2	1	0	0	0	2	1	0	1	1	1	1	0	0
Notoschoenomyza annulata	2	0	0	1	1	0	?	2	1	0	0	?	?	?	?	?	?	?	?	?	?
Notoschoenomyza spinicosta	2	0	0	1	1	0	?	2	1	0	0	0	?	?	?	?	?	?	?	?	?
Ocypodomyia africana	0	0	0	1	1	1	0	1	1	0	0	0	1	1	?	1	?	0	0	0	0
Pachyceramyia cordiluroides	1	2	0	1	1	0	?	1	1	?	0	0	?	1	0	0	1	0	0	0	0
Pachyceramyia robusta	?	?	?	?	?	1	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Palpilongus bifurcus	1	0	1	1	1	0	0	2	1	0	0	0	2	1	1	1	1	1	1	0	0
Phaonia caesiipollinosa	1	0	0	0	1	0	0	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Phaonia californiensis	1	0	0	0	1	0	0	?	1	0	0	0	2	1	0	1	1	0	1	0	0
Phaonia equatorialis	0	0	0	0	1	1	0	?	1	0	0	0	2	1	0	1	1	0	1	0	0
Phaonia quercus	0	0	0	0	1	0	0	?	1	0	0	0	2	1	0	1	1	0	1	0	0
Philornis albuquerquei	1	1	0	1	1	0	0	0	1	0	0	0	?	1	1	0	1	0	?	0	0
Pilispina benevenuta	1	1	1	1	1	0	0	2	1	0	0	0	?	?	1	1	1	?	?	?	?
Pilispina pilitibia	1	0	1	1	1	0	0	2	1	0	0	?	?	?	?	?	?	?	?	?	?
Polietina prima	1	0	0	1	?	0	0	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Reynoldsia robusta	?	?	?	?	1	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Rhabdotoptera striatipennis	2	2	0	0	1	0	0	1	1	0	0	?	?	?	?	?	?	?	?	?	?
Souzalopesmyia paranaensis	0	0	0	0	1	1	0	?	1	0	0	0	0	1	0	1	1	0	1	0	0
Souzalopesmyia amazonica	0	0	0	0	1	1	0	?	1	0	0	0	0	1	0	1	1	0	1	0	0
Souzalopesmyia polleti	0	0	0	0	1	1	0	?	1	0	0	0	0	1	0	1	1	0	1	0	0
Spilogona atricans	0	2	0	1	1	0	?	0	1	1	0	?	?	?	?	?	?	?	?	?	?
Spilogona baltica	0	2	0	1	1	0	?	0	1	1	0	?	?	?	?	?	?	?	?	?	?
Spilogona carbonella	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Spilogona denigrata	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Stomopogon albiseta	1	2	1	0	1	0	0	2	0	0	0	?	?	?	?	?	?	?	?	?	?
Stomopogon capribarba	1	2	1	0	1	1	0	2	0	0	0	?	?	?	?	?	?	?	?	?	?
Stomopogon hirtitibia	?	?	?	?	1	?	?	?	?	?	?	?	?	1	1	1	1	?	?	?	?
Stomoxys calcitrans	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Syllimnophora aliena	0	0	0	0	1	0	?	0	1	0	1	0	2	1	0	0	0	1	1	1	0
Syllimnophora atrovittata	1	0	0	0	1	0	?	0	1	0	0	0	2	1	0	0	0	0	1	1	0
Syllimnophora candidifrons	0	0	0	0	1	0	?	0	1	0	1	0	2	1	0	0	0	1	1	1	0
Syllimnophora clavitibia	0	0	0	0	1	0	?	0	1	0	1	0	2	1	0	0	0	1	1	1	0

S2- MATRIX (PART VIII). MATRIX OF MORPHOLOGICAL CHARACTERS OF MYDAEINAE

	6															7					
Tapantiomyia enigmatica	?	?	?	1	1	0	0	2	1	0	0	?	?	?	?	?	?	?	?	?	?
Tetramerinx inermis	?	?	?	?	1	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Tetramerinx nigripes	2	1	0	1	1	0	?	1	1	0	0	0	?	0	0	0	0	?	?	1	?
Tetramerinx rufitibia	?	?	?	?	?	1	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Thaumasiochaeta compressitarsis	0	0	0	1	1	0	0	0	1	0	0	?	?	?	?	?	?	?	?	?	?
Thaumasiochaeta nigripes	0	0	0	1	1	0	0	0	1	0	0	?	?	?	?	?	?	?	?	?	?
Thaumasiochaeta pilitarsis	1	2	0	1	1	0	0	0	1	0	0	?	?	?	?	?	?	?	?	?	?
Thaumasiochaeta variegata	0	0	0	1	1	0	0	0	1	0	0	?	?	?	?	?	?	?	?	?	?
Villeneuvia aestuun	?	?	?	?	?	?	?	0	?	?	0	0	0	1	1	1	1	?	0	0	?
Xenomyia atra	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?

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CAPITULO II

TOWARD A TAXONOMIC REVISION OF NEOTROPICAL *LIMNOPHORA* ROBINEAU-DESVOIDY (DIPTERA, MUSCIDAE): NEW SPECIES, REDESCRIPTIONS AND KEY TO SPECIES

Toward a taxonomic revision of Neotropical *Limnophora* Robineau-Desvoidy (Diptera, Muscidae): new species, redescriptions and key to species

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ABSTRACT

All Neotropical species of *Limnophora* Robineau-Desvoidy (Diptera, Muscidae) were analyzed. A new species is described *Limnophora* **sp. nov.** 1, from Minas Genais, São Paulo and Rio de Janeiro, Brazil. Redescriptions and notes on all species recorded from the Neotropical region are given, including male and female terminalia illustrations (when sufficient material was available). For the first-time, analyses on the ultrastructural morphology using scanning electron microscope (SEM) from proboscis and male genitalia are provided. We made the following taxonomic changes: *L. piliseta* Stein, 1919 (= *L. snyderi* Lopes & Couri, 1987 **syn. nov.**) and (*L. spreta* Malloch, 1921 **syn. nov.**); *L. narona* Walker, 1849 (= *L. alacris* Stein, 1911, **syn. jun.**) and *L. paranaensis* Albuquerque, 1954 (= *L. altaneira* Albuquerque, 1954, **syn. nov.**), (= *L. paulistana* Lopes & Khouri, 1991 **syn. jun.**). In addition, *L. iniqua* Stein, 1911 is indicated as *incertae sedis*. To facilitate species identification, a *Limnophora* key for all Neotropical species is presented.

Key words: Geographical distribution; key; redescription; taxonomy; ultrastructural morphology.

INTRODUCTION

Limnophora flies include 358 species (Pont *et al.* 2011, Fogaça & de Carvalho 2015) and are worldwide distributed, except in New Zealand (Hennig 1965). In Neotropical region, 48 species are described (de Carvalho *et al*. 2005, Fogaça & de Carvalho 2015). The immature stages are predators and their morphology of it was described by Skidmore (1985) and Rozkošný & Gregor (2004). The adult behavior is also predatory and was described by Skidmore (1985), Werner & Pont (2006), Pont *et al*. (2011) and Pont & Ivković (2013).

Adults can be recognized by the following characters: male eyes separated by no more than one-fifth of the head width, prosternum setulose, wing with cilia on both sides of base of radial sector, sternite 1 bare; ovipositor with segment 8 directed upwards, with spicules; hypoproct elongated, with spicules (Stein 1911, Malloch 1934, Couri & de Carvalho 2002). The identification of adults of *Limnophora* is complex because the species are very morphologically similar and in the available keys presents only to 21 species among 48 species to Neotropical region (Stein 1911, Malloch 1934, Couri & de Carvalho 2002, Fogaça & de Carvalho 2015).

The monophyly and internal relationships of *Limnophora* are still unclear. Hennig (1965) understood that the genus was paraphyletic. Kutty *et al.* (2010, 2014) on phylogenies involving muscid family based on molecular evidence recovered *Limnophora* as monophyletic genus, sister-group of *Lispe* Latreille, 1797 (Kutty *et al.* 2010), or *Heliographa* Malloch, 1921 (Kutty *et al.* 2014). Kutty *et al.* (2010) made the analysis without species from *Heliographa,* but in both studies there are no enough terminals to propose internal relationships to the genus.

Limnophora from Neotropical region was studied by many authors and was summarized by de Carvalho *et al.* (2005). After that, a few works have been made with the genus. Löwenberg-Neto & de Carvalho (2013) provide a geographic database for the muscid endemic to Latin America and they listed 41 species to *Limnophora*. Fogaça & de Carvalho

(2015) described seven new species of *Limnophora* from Ecuador and redescribed *L. marginata* Stein, 1904. In the catalogue of Muscidae from Colombia Perez & de Carvalho (2016) listed four species of *Limnophora*.

Here, we provide redescriptions of all species from the Neotropical region, with the exception of *Limnophora aczeli* Snyder, 1954; *L. cubana* Johnson, 1919; *L. leucotelus* Walker, 1853; *L. limbata* Bigot, 1885 *L. platystoma* Thomson, 1869 and *L.vicina* Robineau-Desvoidy, 1830. Also, descriptions of a new species, *Limnophora* **sp. nov.** 1. In addition, we propose three new synonymies: *L. snyderi* Lopes & Couri, 1987 and *L. spreta* Malloch, 1920 as synonyms of *L. piliseta* Stein, 1919; *L. alacris* Stein, 1911 as new junior synonym of *L. narona* Walker, 1849; *L. altaneira* Albuquerque, 1954 and *L. paulistana* Lopes & Khouri, 1991 as synonyms of *L. paranaensis* Albuquerque, 1954. This study also proposes *L. iniqua* Stein, 1911 as *incertae sedis*. Finally, we provide for the first time images (SEM) from proboscis and male genitalia, a key to the species, an updated generic diagnosis of the genus, and several new records for the Neotropical region.

MATERIAL AND METHODS

Most type species were analyzed, except for the following: *Limnophora aczeli* Snyder, 1954 (Fundación e Instituto Miguel Lillo, Tucumán, Universidad Nacional de Tucumán, Argentina - IMLA, institution not accessed); *L. corvina* (Gliglo-Tos, 1893) (Università di Torino, Instituto e Museo di Zoologia, Torino, Italy – MIZT, institution not accessed); *L. leucotelus* Walker, 1853 (formerly at BMNH, destroyed – de Carvalho et al. 2005); *L. limbata* Bigot, 1885 (Oxford University Museum of Natural History, Oxford, United Kingdom - UMO, institution not accessed); *L. platystoma* Thomson, 1869 (Stockholm, Naturhistoriska Riksmuseet, Sweden - NHRS, institution not accessed) and *L. vicina* Robineau-Desvoidy, 1830 (not in remains of Dejean collection in MNHN or UMO, destroyed – de Carvalho et al. 2005). The material studied is deposited in the following institutions:

AMNH	American Museum of Natural History, New York, USA
BMNH	The Natural History Museum, London, United Kingdom
DZUP	Coleção entomológica Jesus Santiago Moure, Departamento de Zoologia da Universidade Federal do Paraná. Curitiba, Paraná, Brazil
MNHN	Muséum National D'Histoire Naturelle, Paris, France
MNRJ	Museu Nacional, Universidade Federal do Rio de Janeiro, Rio de Janeiro, Brazil
MZSP	Museu de Zoologia da Universidade de São Paulo, São Paulo, Brazil
USNM	National Museum of Natural History, Washington DC, USA
NMW	Naturhistorisches Museum Wien, Vienna, Austria
SMT	Senckenberg Naturhistorische Sammlungen Dresden, Museum für Tierkunde, Dresden, Germany
ZMHU	Museum für Naturkunde, Leibniz-Institut für Evolutions- und Biodiversitätsforschung, Berlin, Germany

The terminology for the external morphology and terminalia follows Cumming and Wood (2017). The following abbreviations were used in diagnoses, key and redescriptions: *a* – anterior, *d* – dorsal, *p* – posterior, *v* – ventral, *ad* – anterodorsal, *av* – anteroventral, *pd* – posterodorsal, *pv* – posteroventral.

Pinned dry specimens were examined under the stereomicroscope and were identified using available keys (Stein 1911, Malloch 1934, Fogaça & de Carvalho 2015) or original descriptions. The terminalia were examined after being removed from the abdomen, then cleared with cold potassium hydroxide, transferred to acetic acid, dehydrated in 70% alcohol and then placed in glycerin. The terminalia were dissected, analyzed and were illustrated under the optical microscope with the help of a camera lucida. After examination, the

terminalia were placed in glass vials that were fixed to the original pinned specimen. Information on the labels of the type material was transcribed exactly as written. In the descriptions below, a bar indicates the end of a line on the label, and quotation marks indicate the beginning and end of the information. Information within parentheses was not on the label.

The locations where specimens were collected (country, locality, longitude, latitude) were extracted from the literature (Löwenberg-Neto & de Carvalho 2013), and from the original specimen labels.

Scanning electronic microscope (SEM) images were taken using a JEOL JSM 6360-LV at Centro de Microscopia Eletrônica, Curitiba, Paraná, Brazil, Universidade Federal do Paraná.

RESULTS

Taxonomy

***Limnophora* Robineau-Desvoidy, 1830**

Type-species, *palustris* Robineau-Desvoidy (Coquillett 1910:561) = *maculosa* (Meigen). Ref.: Couri and Carvalho 2002:178 (partial key to species); de Carvalho et al. 2005 (catalogue); Pérez & de Carvalho 2016 (catalogue).
Microchylum Macquart, 1851a:229; 1851b:256. Type-species, *vittatum* Macquart (orig. des.).
Leucomelina Macquart, 1851a:234; 1851b:261. Type-species, *pica* Macquart (orig. des.).
Bucephalomyia Malloch, 1918b:273. Type-species, Tetramerinx femorata Malloch (orig. des.).

Diagnosis

Male. Holoptic or dichoptic, distance between the eyes never bigger than the length of the postpedicel; presutural dorsocentral setae 0 or 2, postsutural dorsocentral setae 2-5; prosternum setulose; wing with cilia on both sides of base radial sector. Female. Very similar to male, but dichoptic and number of frontal setae is variable; the vittae on thorax, generally stronger than male vittae. *Male terminalia*. Cercus (Fig. 38B) longer than wide, fused on middle, with incisions on proximal and distal parts, proximal part with long setae on inner margin. Phallic complex (Fig. 37), phallapodeme longer than pregonite, distal part no enlarged; epiphallus longer than postgonite, curved; hypandrium plate-like; pregonite joined

to hypandrium with setulae; postgonite curved with setulae and distal part membranous; distiphallus long, about 2.0 times the length of pregonite (sometimes membranous). *Female terminalia* (Fig. 41D–F). Segment 8 upwards directed, with strong spicules.

The characters listed below present in all Neotropical *Limnophora* species are presented in order to avoid redundant descriptions, they will not be repeated.

Male. *Head*. Fronto-orbital plate, face, parafacial and gena gray pruinose. Antenna dark brown. Palpus dark brown. *pc orb s* 1, less developed; *u orb s* absent; *oc s* pair well developed; *poc s* smaller than *oc s*; *i vt s* parallel, with the same length of *oc s*; *o vt s* divergent with the same length of *i vt s*. Antennae inserted on middle of eyes; palpus somewhat enlarged at apex.

Thorax. Postpronotal lobe, notopleuron and katepisternum white pruinose. *ial s* 1+2; *spal s* 1+1; *pal s* 1; *npl s* 2; *b sctl s* with the same *ap sctl s* length; *a kepst s* 1+2 except *Limnophora barbitarsis* and *L. lamasi* (1+1).

Legs. Pulvilli and claws well developed. Fore tibia without median seta. Fore femur *pd* and *pv* with a complete row of setae. Mid femur with 2 *p* in apical half. *Wing*: vein r-m slightly undulate.

Wing. Crossvein r-m almost straight.

Abdomen. Abdomen: dark brown with white pruinose areas. Tergites III to V with developed lateral marginal seta; tergite V with discal seta developed. Sternite 5 trapezoid, longer than wide, with several setae, apical third membranous.

Key to Neotropical *Limnophora* species

1. -Presutural dorsocentral setae absent. Acrostichal setae not differentied. Katepisternal setae 1+1…… *L. lamasi*

-Presutural dorsocentral setae present. Acrostichal setae differentied. Katepisternal setae 1+2…2

2. -Postsutural dorsocentrals 3...4

-Postsutural dorsocentrals 4-5...19

4. -Scutum with two conspicuous and continuous vittae ...5

-Scutum without conspicuous and continuous vittae …7

5. -Wing hyaline yellowish with brown cloudy spots at the costal margin at apex of vein R_{2+3}. Vein *dm-m* almost straight… *L. bifasciata*

- Wing dark brown. Vein *dm-m* sinuous… 6

6. -Eye bare. Frontal setae in 7 pairs… *L. integra*

-Eye sparsely ciliated. Frontal setae in 9-10 pairs… *L. pura*

7. -Scutellum without white pruinosity areas…8

-Scutellum with white pruinosity areas…14

8. -Presutural scutum with vittae on center…9

-Presutural scutum without vittae on center…10

9. -Hind femur with a complete row of long setae on *av*… *L. femurosetalis*

-Hind femur with a row of setae on *av* only in the apical half … *L. albuquerquei*

10. -Vein R_1 bare…*L. equatoriensis*

-Vein R_1 with setulae on basal or apical half…11

11. -Vein R_1 with conspicuous setulae on dorsal and ventral surface. Fore tibia with a median seta on posterior surface… *L. penai*

-Vein R_1 with conspicuous setulae only on dorsal surface. Fore tibia without a median seta on posterior surface… 12

12 -Distance between eyes about 0.08 times head width. Vein R_1 with conspicuous setulae on median half on dorsal surface… *L. marginata*

-Distance between eyes absent. Vein R_1 with conspicuous setulae on apical half in dorsal surface… 13

13. -Thorax with white pruinose areas on apical half. Vein *dm-m* almost straight… *L. gracilitarsis*

-Thorax without white pruinose areas on apical half. Vein *dm-m* sinuous… *L. nigrargentata*

14. -Vein R_1 dorsally bare...14

-Vein R_1 dorsally with setulae…16

15. -Arista plumose. Presutural scutum with two vittae on center. Vein dm-m almost straight…*L. garrula*

-Arista with short hairs. Presutural scutum without two vittae on center. Vein dm-m sinuous…*L. ovativentris*

16. -Distance between eyes absent. Postsutural scutum with large horizontal dark brown vitta… 17

-Distance between eyes present. Postsutural scutum without large horizontal dark brown vitta… *L. longivittata*

17. -Face setulose on frontogenal suture. Wing hyaline yellowish with brown cloudy spots at the costal margin at apex of vein R_{2+3}…*L. barbitarsis*

-Face bare on frontogenal suture. Wing hyaline yellowish without brown cloudy spots at the costal margin at apex of vein R_{2+3}…18

18. -Frontal setae in 4 pairs. Transverse suture with two white vittae … *L. snyderi*

-Frontal setae in 8 pairs. Transverse suture without two white vittae … *L. deleta*

19. -Dorsoncetral setae 2+5...20

-Dorsocentral setae 2+4...21

20. -Vein R_1 dorsally bare. Arista pubescent with long hairs… *L. corvina*

- Vein R_1 dorsally setulose. Arista pubescent with short hairs. *L. paranaensis*

21. -Scutum with two conspicuous and continuous vittae ...22

-Scutum without conspicuous and continuous vittae …23

22. -Distance between eyes present. Wing dark brown… *L. breviseta*

-Distance between eyes absent. Wing hyaline yellowish… *L. exul*

23. -Scuttelum without white pruinose areas…24

-Scuttelum with white pruinose areas…25

24. -Meron and sternite 1 setulose…*L. polleti*

-Meron and sternite 1 bare…26

25. -Postsutural scutum with white pruinose areas. Wing hyaline yellowish…*L. pica*

-Postsutural scutum without white pruinose areas. Wing brownish…*L. lopesae*

26. -Vein R_1 dorsally setulose… *L. piliseta*

-Vein R_1 dorsally bare...27

27. -Arista with long hairs...28

-Arista with short hairs or bare…29

28. -Distance between eyes present. Presutural scutum with white vita on center. Wing hyaline yellowish… *L. minuscula*

-Distance between eyes absent. Presutural scutum without white vita on center. Wing brownish… *L. saeva*

29. -Scutum without white pruinose areas on center… *L. vittata*

-Scutum with white pruinose areas on center…30

30. -Distance between eyes present… 31

-Distance between eyes absent…*L. narona*

31. -Vein R_1 dorsally bare… *L. patagonica*

-Vein R_1 dorsally setulose... *L. laeta*

***Limnophora* sp. nov.** Fogaca & de Carvalho, 2019
(Figs 1A–E, 38A–C)

Description. Holotype, male (Fig. 1A). Ground-color dark brown, with silvery-white pruinose areas. *Head* (Fig. 1B, D). Palpus brown with gray pruinose. *Thorax* (Fig. 1C). ground color black; scutum with 2 white vittae on prescutum and two white vittae near scutellum; scutellum dark brown without vitta. *Wings* (Fig. 1A, C). Very weakly smoky, brownish. Calypteres whitish with darkened borders. *Legs*. Brown.

Head (Fig. 1B, D). Holoptic, distance between the eyes almost null, eyes sparsely ciliated. *fr s* 9. Ocellar triangle with many developed setae, but smaller than *oc s.* Postpedicel about 1.5 times pedicel length. Arista long, pubescent, with very short cilia.

Thorax chaetotaxy. *acr s* 0+1; *dc s* 2+3, the first two postsutural less developed; *b pprn s* 2; *npl s* 2; *anepst* 6.

Legs chaetotaxy. Pulvilli and claws reduced. Fore tibia *d* and *pv* with one apical seta. Mid femur *v* with a row of short setae in basal half; *p* two setae in apical half. Mid tibia *p* with two median setae; *d*, *a*, *v*, *p* one apical seta. Hind femur *ad* a complete row of long setae, *av* with a row of long apical half; *pv* with a row of long apical half. Hind tibia *av* with three developed setae in median half; *d* and *av* with apical seta.

Wings. Vein R_1 dorsally setulose in apical half; apical portion of the vein M bent toward vein R_{4+5}.

Abdomen. Sternite1bare; sternite 5 trapezoid, longer than wide, with several setae, apical third membranous (Fig. 38A).

Male terminalia. Cercus (Fig. 38B) longer than wide, fused on middle, with incisions on proximal and distal part, proximal part with long setae on inner margin. Phallic complex

(Fig. 38C), phallapodeme longer than pregonite, distal part not enlarged; epiphallus longer than postgonite, curved; hypandrium in plate-like; pregonite joined to hypandrium with setulae; postgonite curved with setulae and distal part membranous; distiphallus long, about 2.0 times the length of pregonite, distal part membranous.

Female. Unknown.

Type-material. Holotype. Male (Fig. 1D). "BRAZIL, MG: \ Itatiaia, 1800 m \ 25-27. iv. 96 Pont [white, printed label]"; "Pres. by A. C. Pont \ BMNH (E) 2006-133 [white, printed label]" (DZUP). Paratypes 3 ♂. Brazil. São Paulo, Eng. Lefreve, 1200m, C. do Jordao, 24. i. 1963, J. Guimaraes, Medereiros, L. Silva, A. Rocha & L. T. F. col. (2♂, MZUSP). Mury, Nova Friburgo, Rio de Janeiro, 1-31. i. 1965, Gred & Guimaraes col. (1♂, DZUP).

Remarks. The Holotype and paratypes are in good condition.

Distribution. Brazil, Minas Gerais, São Paulo and Rio de Janeiro.

***Limnophora albuquerquei* Lopes & Couri, 1987**

(Figs 2A–C, 3A–C)

The complete reference list is available in de (Carvalho et al. 2005). After the catalogue: Löwenberg-Neto & de Carvalho 2013 (check-list).

Redescription. Paratype, male (Fig. 3A). Ground-color dark brown, with silvery pruinose areas. *Head* (Fig. 3D). Antenna dark brown. Palpus light brown. *Thorax* (Fig. 2B, 3C). Black, with two narrows white vittae along planes of dorsocentral seta which extends to base of scutellum. Notopleuron bare, with gray pruinose. katepisternum black, with silvery pruinose. Calypters whitish. Wing hyaline yellowish. *Legs*. Dark brown.

Head. Dichoptic, distance between the eyes about 0.10 the width of the head, eyes bare. *fr s* 8-9; *i vt s* and *o vt s* are damaged in the paratype. Postpedicel about 1.5 times pedicel length. Arista long, pubescent, with very short cilia.

Thorax chaetotaxy. *acr s* 0+1; *dc s* 2+3; *b pprn s* 4, two less developed; *anepst* 5; *b sctl s* was damaged in the paratype.

Legs chaetotaxy. Fore tibia *d*, *pv* with one apical seta. Mid femur in *d* with (2) long setae in median half; *v* with a row of (7) long in basal half; (2) setae *p* in apical half. Mid tibia *p* with (2) median setae; *p*, *v*, with one apical seta. Hind femur *ad* with a complete row of long setae, *av* with a row of long setae in apical half. Hind tibia *ad, av* with a median seta; *d* and *av* with one apical seta.

Wing. Vein R_1 was damaged in the paratype; apical portion of the vein M bent toward vein R_{4+5}; crossvein r-m slightly undulate.

Abdomen. First sternite bare; sternite 5 trapezoid, longer than wide, with several setae, apical third with very short setae (Fig. 2; Lopes & Couri 1987, p. 221).

Male terminalia. Cercus (Fig. 3; Lopes & Couri 1987, p. 221) wider than long, fused on distal part, with incisions on proximal and distal part, covered with long setae. Phallic complex (Fig. 5; Lopes & Couri 1987, p. 221), phallapodeme similar length of the postgonite, distal part not enlarged; epiphallus longer than postgonite; hypandrium in plate-like; postgonite curved with setulae.

Female. Not examined.

Type-material examined. Holotype male (Fig. 2C). “Fruticultura Bocaina \ S. Paulo, Brasil [White printed label, head detached and glued on label]”; “D. O. Albuquerque \ 23. xi. 70 [white label, partially handwritten]”; “Holotipo ♂ [red printed label]”; “*Heliographa albuquerquei* \ sp. nov. \ S. Lopes det. [white handwritten label], (MNRJ). Paratype male. Huariaca, Peru, 20. xii. 13 (MNRJ).

Material additional examined. 5 ♂ from same locality, 4 ♂ 23.xi.70 (MNRJ), e 1 ♂26.xi.70 (MNRJ); 3 ♂, Campos do Jordão, Eng. Lefévre, 1200 m, 21. ii. 63, J. Guimarães, Morgante, Rocha, Barroso e L. T. F. (MNRJ), 1 ♂, Rio de Janeiro, Petrópolis, Le Vallon, Alto da Mosela, 1. ii–8. iii. 57, Albuquerque (MNRJ).

Distribution. Brazil and Peru.

Remarks. The holotype ♂ is in bad condition. Only preserved are thorax, right anterior leg, tleft hind leg and head that has been separated from the thorax and is fixed on the label of origin. The genitalia, was dissected and preserved in plastic tube with glycerin and fixed next to the holotype. Paratype ♂ in excellent condition. Only the wings are significantly damaged, and the right hind leg was lost.

***Limnophora aurifacies* Stein, 1911**

(Figs 4A–D)

The complete reference list is available in de (Carvalho et al. 2005). After the catalogue: Pont 2013 (notes on type) Löwenberg-Neto & de Carvalho 2013 (check-list).

Redescription. Lectotype, female (Fig. 4A). Dark brown, with silvery pruinose. *Head* (Fig. 4C). Frontal vitta black, fronto-orbital plate, parafacial, gena yellow pruinose; face, with gray pruinose. *Thorax* (Fig. 4B). with two white conspicuous vittae along planes of dorsocentral seta which extends to apex of scutellum. Calypters whitish. Wing hyaline. *Legs*. Brown, with gray pruinose.

Head. Dichoptic, distance between the eyes about 0.33 the width of the head, eyes sparsely ciliated. *fr s* 4, 2 less developed; *pc orb s* absent; *u orb s* 2; *oc s* pair well developed; *poc s* smaller than *oc s*; *i vt s* convergent; *o vt s* divergent. Postpedicel about 1.5 times of pedicel length. Arista long, pubescent, apical half bare.

Thorax chaetotaxy. *acr s* 0+1; *dc s* 2+4, the first two less developed; *b pprn s* 2; *anepst* 7; *b sctl s* with the same *ap sctl s* length.

Legs. Pulvilli and claws well reduced. Fore tibia *d*, *pv* with one apical seta. Mid femur *a* with a row of short setae in basal half; *v* with a row of long setae in basal half; *p* with two setae in apical half. Mid tibia *p* with a median seta; *ad*, *av*, *pv and p* with one apical seta. Hind femur *ad* with a complete row of long setae, *av* with a row of long in apical half. Hind tibia *ad, av* with one seta in median half; *ad* and *av* with one apical seta.

Wing. Vein R_1 bare; apical portion of the vein M bent toward vein R_{4+5}; crossvein r-m slightly undulate.

Terminalia not examined.

Type-material examined. Lectotype female (Fig. 1D). "Bolivia \ 20.xii.02 \ Sorata 2300m [green printed label, date handwritten]"; "Coll. W. Schnuse\ 1911 - 3 [green printed label]"; "Unreadable writing [green handwritten label]"; "LECTOTYPE ♀ \ Limnophora\ aurifacies \ Stein, 1911 \ Des. A. C. Pont 1999 [white printed label]" (SMT). Paralectotipos 6 ♀ (Same locality, 21.xii.02, 1♀ (SMT); La paz, 30. xi. 02, 1♀ (ZMHU); Peru-Laristhal, 8. viii. 03, 1♀ (SMT); Calca, 6. viii. 03, 2♀ (SMT, ZMHU); Cuzco, vii. 03, 1♀ (SMT).

Material additional examined. Bolivia, Sorata, 2300, v. 1903, 1♀ (SMT).

Distribution. Peru, Bolivia, Brazil and Argentina.

Remarks. The lectotype is in good condition, but the left wing is damaged. The male not examined. The male and female terminalia are described in Couri & Lopes (1987).

***Limnophora barbitarsis* Stein, 1911**

(Figs 5A–D, 6A–C, 39A–C)

The complete reference list is available in de (Carvalho et al. 2005). After the catalogue: Pont 2013 (notes on type) Löwenberg-Neto & de Carvalho 2013 (check-list).

Redescription. Lectotype, male (Fig. 5A). Ground-color dark brown, with silvery pruinose. *Thorax* (Fig. 5B). black, with two white conspicuous vittae on prescutum and

scutum with two conspicuous white vittae near base of scutellum. Calypters whitish, with darkened borders. Wing very smoky, brownish. *Legs*. Dark brown.

Head (Fig. 5C). Holoptic, distance between the eyes almost null, eyes sparsely ciliated. *fr s* 17. Postpedicel about 2 times pedicel length. Arista long, pubescent, with very short cilia.

Thorax chaetotaxy. *acr s* 0+0; *dc s* 0-1+2-3; *b pprn s* 2; *anepst* 6; *b sctl s* with the same *ap sctl s* length.

Legs chaetotaxy. Fore tibia *d*, *pv* with one apical seta; anterior tarsi *d* with projections. Mid femur *v* with a row of slender setae. Mid tibia *p* with two median setae; *d, av, v, pv* with apical seta. Hind femur *ad* and *av* with a complete row of setae, *pd* with a row of setae in apical half. Hind tibia *ad* and *av* with a median seta*; ad* and *av* with a preapical seta.

Wing. Vein R_1 dorsally with setulae on apical half; apical portion of the vein M bent toward vein R_{4+5}; crossvein r-m almost straight.

Abdomen. Sternite1bare; sternite 5 trapezoid, longer than wide, with several setae, two bigger setae on middle part, apical third membranous (Fig. 39A).

Male terminalia. Cercus (Fig. 39B) longer than wide, fused on middle, with incisions on proximal and distal part, proximal part with long setae on inner margin. Phallic complex (Fig. 39C), phallapodeme similar length of postgonite, distal part not enlarged; epiphallus longer than postgonite, curved; hypandrium in plate-like; pregonite joined to hypandrium with setulae; postgonite curved with setulae and distal part membranous; distiphallus long, about 2.0 times the length of pregonite, distal part membranous.

Female. Similar to male, but dichoptic, distance between the eyes about 0.30 the width of the head. *fr s* 6 week developed. Fore tarsi without projections.

Female terminalia (Fig. 39D–F). Tergites 6 and 7 complete; tergite 8 divided dorsally. Sternites 6 and 7 narrow, plate-like; sternite 8 very reduced. Epiproct with conspicous setae.

Hypoproct elongated, with spines apically and upward directed. Cercus globose with conspicuous setae. 3 spermathecae.

Type-material examined. Lectotype, Male (Fig. 5D). “Bolivia - Mapiri \ 1000m 7.v. 03\ Lorenzopata [green printed label, date handwritten]”; “Coll. W. Schnuse\ 1911 - 3 [green printed label]”; “LECTOTYPE ♂ \ Limnophora\ barbitarsis \ Stein, 1911 \ Des. A. C. Pont 1999 [white printed label]” (SMT). Paralectotypes 4♂ e 2 ♀. (Same locality, 7. v. 03, 1♂ (SMT); 28. iv. 03,1 ♀ (SMT); 1. v. 03, 1♂ (ZMHU). Peru, Laristhal, 2-3000m, 10. viii. 03, 1♂ (SMT); Tarma, 19. i. 04, 1♂ 1♀ (SMT).

Additional material examined. Bolivia, Mapiria 28. iv. 03, 1♂ 1♀; 8.v. 03, 1♂; 10.v.03, 1♂; 11. v. 03. 1♂; 1.v. 03, 1♂; 21. v. 03, 1♂; 20. v. 03, 1♀; 29. v. 03, 1♀ (SMT).

Distribution. Bolivia.

Remarks. The lectotype is in good condition. Some specimens the setulae on vein R_{4+5} almost touching the crossvein r-m.

Limnophora bifasciata Fogaça & de Carvalho, 2015

The complete description and photos are available in Fogaça & de Carvalho (2015) (Figs 7–12, p. 213).

Diagnosis. *dc s* 2+3; vein R_1 dorsally setulose on apical half; prescutum dark brown with conspicuous white vittae become wider near scutellum Fogaça & de Carvalho (2015).

Limnophora brevihirta Malloch, 1934

(Figs7A–D)

The complete reference list is available in de (Carvalho et al. 2005). After the catalogue: Löwenberg-Neto & de Carvalho 2013 (check-list).

Redescription. Allotype, female (Fig. 7A). Dark brown, with silvery pruinose. *Head*. Frontal vitta black. Antenna dark brown. Palpus dark brown. *Thorax* (Fig. 7B). black, scutum with two narrows white vitta extending to scutellum apex. Calypters whitish. Wing hyaline. *Legs*. Brown.

Head (Fig. 7C). Dichoptic, distance between the eyes 0.33 the width of the head, eyes sparsely ciliated. *fr s* 4; *pc orb s* 2; *u orb s 2*; *oc s* pair well developed; *poc s* smaller than *oc s*; *i vt s* parallel, with the same length of *oc s*; *o vt s* divergent with the same length of *i vt s*; Antennae inserted on middle of eyes, postpedicel about 1.5 times pedicel length. Arista long, pubescent.

Thorax chaetotaxy. *acr s* 0+1; *dc s* 2+4, the first two postsutural less developed; *b pprn s* 2; *npl s* 2; *anepst* 6; *b sctl s* with the same *ap sctl s* length.

Legs. Pulvilli and claws reduced. Fore tibia *d*, *pv* with one apical seta. Mid femur on *a* row of short setae in basal half; *v* with a row of long setae on basal half; *p* with two setae in apical half. Mid tibia *p* with one median seta; *d*, *a*, *v*, *p* with one apical seta. Hind femur *ad* and *pv* complete row of long setae; *av* with a row of long setae in apical half. Hind tibia *ad* and *av* with seta in median half; *d* and *av* with apical seta.

Wing. Vein R_1 bare; apical portion of the vein M bent toward vein R_{4+5}; crossvein r-m undulate with projections.

Abdomen. Tergites III to V with developed lateral marginal seta; tergite V with developed discal seta. First sternite bare.

Terminalia. Not examined.

Type-material examined. Allotype, female (Fig. 7D). "Allo \ type [white printed label]"; "Argentina: \ Buenos Aires. \ 21. x. 1926 \ F. & M. Edwards. \ B. M. 1927 - 63. [white printed label]"; "*Limnophora* \ *brevihirta* \ det. JR Malloch [white, printed label and partially handwritten]" (BMNH).

Distribution. Chile and Argentina.

Remarks. The allotype is in good condition.

***Limnophora breviseta* Stein, 1911**

(Figs 8A–D, 40A–C)

The complete reference list is available in de (Carvalho et al. 2005). After the catalogue: Pont 2013 (notes on type) Löwenberg-Neto & de Carvalho 2013 (check-list).

Redescription. Lectotype, male (Fig. 8A). Ground-color dark brown with silvery pruinose. *Thorax* (Fig. 8B). Black, scutum with two white conspicuous vittae extending to scutellum apex. Calypters whitish. Wing brown infuscate. *Legs*. dark brown.

Head (Fig. 8C). Dichoptic, distance between the eyes bigger than length of the pedicel, eyes bare. *fr s* 6; *pc orb s* 1, less developed. Postpedicel with similar length of pedicel. Arista long, pubescent, with very short cilia, apical half bare.

Thorax chaetotaxy. *acr s* 0+1; *dc s* 2+4, the las pair more developed; *b pprn s* 2; *anepst* 5; *b sctl s* with the same *ap sctl s* length

Legs. Fore tibia *d*, *pv* with one apical seta. Mid femur *a* and *v* with a row of long setae in basal half; *p* with two preapical setae. Mid tibia *p* with two median setae; *d, a, v, pv* with one apical seta. Hind femur *ad* with a complete row of setae; *pv* with a row of setae in apical half. Hind tibia *ad* and *av* with a median seta; *ad* and *av* with apical seta.

Wing. Vein R_1 bare; apical portion of the vein M bent toward vein R_{4+5}; crossvein r-m almost straight.

Abdomen. Sternite1bare; sternite 5 trapezoid, longer than wide, with several setae, apical third membranous (Fig. 40A).

Male terminalia. Cercus (Fig. 40B) longer than wide, fused on middle, with incisions on proximal and distal part, proximal part with long setae on inner margin. Phallic complex (Fig. 40C), phallapodeme longer than pregonite, distal part weakly enlarged; epiphallus longer than postgonite, curved; hypandrium in plate-like; pregonite joined to hypandrium with setulae; postgonite curved with setulae and distal part membranous; distiphallus long, about 2.0 times the length of pregonite, distal part membranous.

Female. Unknown.

Type-material examined. Lectotype, male (Fig. 8D). “Bolivia – Mapiri \ 2000m 1. v. 03 [green printed label, date handwritten]”; “Coll. W. Schnuse\ 1911 - 3 [green printed label]”; “Limnophora \ breviseta \ sp nov [label handwritten]”; “LECTOTYPE ♂ \ Limnophora\ breviseta \ Stein, 1911 \ Des. A. C. Pont 1999 [white printed label]” (SMT). Paralectotypes 3♂. Same data as Lectotype 1♂ (SMT); Same locality, 31. iv. 03, 1♂ (SMT). Peru, Cuzco, vii. 03, 1♂ (SMT).

*Additional material examined***.** Bolivia, Mapiri, Lorenzopata 26. iv. 03, 2♂; 29. iv. 03, 2♂; 6. iv. 03, 1♂; 12. iv. 03, 1♂ (SMT).

Distribution. Peru and Bolivia.

*Remarks***.** The lectotype is in good condition, lost only parts of the right antenna.

***Limnophora corvina* (Gliglo-Tos, 1893)**

(Figs9A–D)

The complete reference list is available in de (Carvalho et al. 2005). After the catalogue: Löwenberg-Neto & de Carvalho 2013 (check-list).

Diagnose. Nontype, male (11) (Fig. 9A). Coloração. Ground-color dark brown with silvery pruinose. *Thorax* (Fig. 9B). Black, prescutum with two white conspicuous vittae; scutum with two white vittae near to scutellum. Calypters whitish. Wing yellowish. *Legs*. brown.

Head (Fig. 9B). Holoptic, distance between the eyes smaller than width of pedicel, eyes bare. *fr s* 6-7. Postpedicel about 1.5 times pedicel length. Arista long, pubescent.

Thorax chaetotaxy. *acr s* 0+1; *dc s* 2+5, the first three pair less developed; *b pprn s* 2; *anepst* 5; *b sctl s* with the same *ap sctl s* length.

Legs. Fore tibia *d*, *pv* with one apical seta. Mid femur *a* and *v* with a row of long setae in basal half; *p* with two preapical setae. Mid tibia *p* with a median seta; *d, a, v, pv* with one

apical seta. Hind femur *ad* with a complete row of setae; *pv* with a row of setae in apical half. Hind tibia *ad* and *av* with a median seta; *ad* and *av* with apical seta.

Wing. Vein R_1 bare; apical portion of the vein M parallel with vein R_{4+5}; crossvein r-m almost straight.

Abdomen. Sternite1bare; sternite 5 trapezoid, longer than wide, with several long setae, apical third membranous (Fig. 7; Couri & Lopes 1987, p. 788).

Male terminalia. Cercus (Fig. 8; Couri & Lopes 1987, p. 788) longer than wide, with incisions only in distal part, covered by many setae. Phallic complex (Figs 10-11; Couri & Lopes 1987, p. 788), phallapodeme longer than pregonite, distal part weakly enlarged; epiphallus smaller than postgonite, curved; hypandrium in plate-like; pregonite joined to hypandrium with setulae; postgonite curved with setulae and distal part membranous; distiphallus long, about 2.0 times the length of pregonite, distal part membranous.

Female. Not examined.

Material type. Not examined.

Additional material examined. Chile, Arica (All from Schnuse) 6. xi. 1902, 7♂ (SMT); 7. xi. 1902, 1♂ (SMT); 5. xi. 1902, 1♂ (SMT); 4. xi. 1902, 1♂ (SMT). Mexico, Vera Cruz 1903-172, 1♂ (Fig. 9D) (BMNH).

Distribution. Mexico, Guatemala, Honduras, Belize, Puerto Rico, Costa Rica, Venezuela, Peru, Brazil and Chile.

Remarks. The specimens are in good conditions.

***Limnophora deleta* (Wulp, 1896)**

(Figs 10A–D)

The complete reference list is available in de (Carvalho et al. 2005). After the catalogue: Löwenberg-Neto & de Carvalho 2013 (check-list), Pérez & de Carvalho 2016 (catalogue).

Redescription. Lectotype, male (Fig. 10A). Ground-color dark brown with silvery pruinose. *Thorax* (Fig. 10B). Black, scutum with two white conspicuous vittae near to base of scutellum. Calypters whitish. Wing light brown infuscate. *Legs*. dark brown.

Head (Fig. 10C). Holoptic, distance between the eyes almost null, sparsely ciliated. *fr s* 8; Postpedicel 1.5 times the pedicel length. Arista long, pubescent, with short cilia.

Thorax chaetotaxy. *acr s* 0+1; *dc s* 2+3; *b pprn s* 2; *anepst* 5; *b sctl s* with the same *ap sctl s* length.

Legs. Fore tibia *d*, *pv* with one apical seta. Mid femur *a* and *v* with a row of long setae in basal half; *p* with two preapical setae. Mid tibia *p* with a median and supramedian setae; *d, a, v, p* with one apical seta. Hind femur *ad* with a complete row of setae; *av* with a row of setae in apical half, *pv* with a complete row of setae. Hind tibia *ad* and *av* with a median seta; *ad* and *av* with an apical seta.

Wing. Vein R_1 dorsally with setulae on apical half; vein R_{4+5} dorsally with setulae beyond the crossvein r-m, apical portion of the vein M bent toward vein R_{4+5}; crossvein r-m almost straight.

Abdomen. First sternite bare.

Terminalia. Not examined.

Female. Similar to male.

Type-material examined. Lectotype (Fig. 10D) we have labelled the ♂ herewith as **lectotype**. “Syn- \ TYPE [white printed label with blue border]”; “B.C.A Dipt. II. \ Leucomelina \ deleta \ v. d. W. [white printed label]”; “Omilteme\ Guerrero \ 8000 ft. \ July. H. H. Smith. [White printed label]”; “CENT. AMERICA: \ F. D. Godman &. \ O. Salvin. \ B. M. 1903-172 [white printed label]”; “NHMUK 010862672 [white printed label] “LECTOTYPE ♂ \ Limnophora\ deleta \ (Wulp, 1896) \ Des. J. M. Fogaça and \ C. J. B de Carvalho 2019 [white printed label]” (BMNH).

Additional material examined. (All from Schnuse). Peru Laristhal, 800 - 2000m, 16. viii. 03 1♂ (SMT); 2 – 3000m, 12. viii. 02, 1♀ (SMT).

Distribution. Mexico, Guatemala, Venezuela, Peru and Brazil.

Remarks. The lectotype is in good condition. The additional material examined is damaged, meanly the female. In the catalogue (de Carvalho et al. 2005) are cited more syntypes deposited in (Illinois Natural History Survey, Champaign, Illinois, USA -INHS, and Universiteit van Amsterdam, Instituut voor Taxonomische Zoologie, Zoologisch Museum, Amsterdam, Netherlands - ZMAN), but in this study this material was not examined.

***Limnophora elegans* Macquart, 1843**

(Figs 11A–C)

The complete reference list is available in de (Carvalho et al. 2005). After the catalogue: Pont 2012 (notes on types), Löwenberg-Neto & de Carvalho 2013 (check-list).

Notes. Lectotype, male (Fig. 11A). The lectotype is dirty, the coloration was not described.

Head (Fig. 11B). Holoptic, distance between the eyes is almost null, eyes bare. *fr s* 5; *pc orb s*; *u orb s*; *oc s*; *poc s*; *i vt* are damaged in the lectotype. Postpedicel about 2.5 times pedicel length.

Thorax chaetotaxy. *acr s* 0+1; *dc s* 2+4; *b pprn s* 2; *npl s* 2; *anepst* 6; *b sctl s* was damaged in the lectotype.

Legs. Fore tibia *d*, *pv* with apical seta. Mid femur and mid tibia damaged. Hind femur *ad* with a complete row of long setae. Hind tibia *ad, av* with seta in median half; *d* and *av* with one apical seta.

Wing. Vein R_1 bare; apical portion of the vein M bent toward vein R_{4+5}; crossvein r-m almost straight.

Abdomen. Sternite1bare; sternite 5 trapezoid, longer than wide, with several short setae, apical third, in lateral part with many short setae (Fig. 12; Couri & Lopes 1987, p. 788).

Male terminalia. Cercus (Fig. 13; Couri & Lopes 1987, p. 788) longer than wide, fused on middle, with incisions on proximal and distal part, proximal part with very long setae on inner margin. Phallic complex (Figs 14-15; Couri & Lopes 1987, p. 789), phallapodeme longer than pregonite, distal part no enlarged; epiphallus longer than postgonite, curved; hypandrium in plate-like; pregonite joined to hypandrium with setulae; postgonite curved with setulae and distal part membranous; distiphallus long, about 1.5 times the length of pregonite, distal part membranous.

Female. Unknown

Type-material examined. Lectotype, male (Fig. 11C). “MNHN, Paris \ ED8527 [white printed label]”; “LECTOTYPE [red printed label]”; “2896 \ 34 [white hand-written label]”; “TYPE [red printed label]”; “elegáns [white hand-written label]”; “308 [white hand-written label]”; “LECTOTYPE ♂ \ designated by \ A. C. Pont 1998 \ Limnophora \ elegans \ Macquart [printed and hand-written label]” (MNHN).

Distribution. Mexico, French Guiana and Brazil.

Commentary. The lectotype is in bad condition. For more information, see Pont (2012).

***Limnophora equatoriensis* Fogaça & de Carvalho, 2015**

The complete description and photos are available in Fogaça & de Carvalho (2015) (Figs 13–18, p. 214).

Diagnosis. *dc s* 2+3; vein R_1 bare; vein R4+5 *d* setulose near of the base of the radial sector Fogaça & de Carvalho (2015).

Limnophora exul Williston, 1896

(Figs 12A–D)

The complete reference list is available in de (Carvalho et al. 2005). After the catalogue: Löwenberg-Neto & de Carvalho 2013 (check-list).

Redescription. Lectotype, male (Fig. 12A). Dark brown, with silvery pruinose. *Thorax* (Fig. 12B). black, with two white conspicuous vittae along planes of dorsocentral seta which extends to apex of scutellum. Calypters whitish. Wing hyaline yellowish. *Legs*. brown.

Head (Fig. 12C). Holoptic. Distance between the eyes almost null, eyes sparsely ciliated. *fr s* 6. Postpedicel about 2 times pedicel length. Arista long, short plumose, apical half bare.

Thorax chaetotaxy. *acr s* 0+1; *dc s* 2+4, the first two postsutural less developed; *b pprn s* 2; *npl s* 2; *anepst* 6; *b sctl s* with the same *ap sctl s* length

Legs. Fore tibia *d*, *pv* with apical seta. Mid femur *a* and *v* with row short setae in basal half; *p* with two setae in apical half. Mid tibia *p* with one median seta; *d*, *a*, *v*, *p* with apical seta. Hind femur *ad* with complete row of long setae; *av* with a row (3) of long setae on apical half. Hind tibia on *ad, av* with seta on median half; *d* and *av* with apical setae.

Wing. Vein R_1 bare; apical portion of the vein M bent toward vein R_{4+5}; crossvein r-m almost straight.

Abdomen. First sternite bare.

Terminalia. Not examined.

Female. Unknown.

Type-material examined. Lectotype, male (Fig. 12D), we have labelled the ♂ herewith as **lectotype**. “Syn \ type [white printed label]”; “Windward side: \ St. vicent, W. I. \ H. H. Smith [white printed label]”; “W. Indies. \ 1907 – 66. [white printed label]”; “LECTOTYPE ♂ \ Limnophora\ exul \ Wulp, 1896 \ Des. J. M. Fogaça and \ C. J. B de Carvalho 2019 [white printed label]” (BMNH). Paralectotypes. Same data as Lectotype 4♂ (BMNH).

Distribution. Cuba, Jamaica and St. Vincent.

Remarks. The lectotype is in good condition.

Limnophora femurosetalis Fogaça & de Carvalho, 2015

The complete description and photos are available in Fogaça & de Carvalho (2015) (Figs 19–24, pp. 215–216).

Diagnosis. *dc s* 2+3; vein R_1 dorsally setulose on apical half; hind femur *ad* and *av* with a complete row of setae; *fr s* 10 Fogaça & de Carvalho (2015).

Limnophora garrula Gliglio-Tos, 1893

(Figs 13A–D)

The complete reference list is available in de (Carvalho et al. 2005). After the catalogue: Löwenberg-Neto & de Carvalho 2013 (check-list).

Notes. Nontype, male (Fig. 13A). Dark brown, with silvery pruinose. *Thorax* (Fig. 13B). Black, scutum with two white vittae near to scutellum base. Calypters whitish. Wing hyaline yellowish. *Legs*. brown.

Head (Fig. 13C). Holoptic, distance between the eyes smaller than width of pedicel, eyes sparsely ciliated. *fr s* 8. Postpedicel about 1.5 times pedicel length. Arista long, short plumose.

Thorax chaetotaxy. *acr s* 0+1; *dc s* 2+3; *pal s* 1; *b pprn s* 2; *anepst* 7; *b sctl s* with the same *ap sctl s* length

Legs. Fore tibia *d*, *pv* with apical seta. Mid femur *a* with a row of short setae in basal half; *v* with a row of long setae in basal half; *p* with two setae in apical half. Mid tibia *p* with two median setae; *a*, *v*, *p* apical setae well developed. Hind femur *ad* with a complete row of long setae; *av* with a row (5) of long setae on apical half. Hind tibia *ad, av* with one seta in median half; *d* and *av* with apical seta.

Wing. Vein R_1 bare; apical portion of the vein M bent toward vein R_{4+5}; crossvein r-m almost straight.

Abdomen. First sternite bare.

Male terminalia. Distiphallus long, about 2 times the length of pregonite; postgonite almost straight and smaller than epiphallus, with a few setulae on apex (Figs 14–15; Couri & Lopes 1987, p. 790).

Female. Similar to male, but dichoptic, *fr s* 3, 2 less developed; *u orb s* 1. *o vt s* divergent; *i vt s* convergent. Hind femur *av* (2) setae in apical half.

Type-material examined. Not examined.

Additional material examined. Central America, Omilteme, Guerrero, 800ft, F. D. Godman & O. Salvin. B. M. 1903 - 172, 2♂ 1♀ (Fig. 13D) (BMNH); Sierra de las Aguas Escondidas, Guerrero, 7000 ft, July H. H. Smith, F. D. Godman & O. Salvin. B. M. 1903 – 172, 4♂ 2♀ (BMNH).

Distribution. Mexico, Brazil and Argentina.

***Limnophora gracilitarsis* Stein, 1911**

(Figs14A–D)

The complete reference list is available in de (Carvalho et al. 2005). After the catalogue: Pont 2013 (notes on type) Löwenberg-Neto & de Carvalho 2013 (check-list), Pérez & de Carvalho 2016 (catalogue).

Redescription. Lectotype, male (Fig. 14A). Dark brown, with silvery pruinose. *Thorax* (Fig. 14B). Black, scutum with two white conspicuous vitta near to base of scutellum. Calypters whitish, with more pigmented borders. Wing hyaline bronwish, with upper border darkened. *Legs*. brown.

Head (Fig. 14C). Holoptic, distance between the eyes almos null, eyes sparsely ciliated. *fr s* 9. Postpedicel about 2 times pedicel length. Arista long, pubescent.

Thorax chaetotaxy. *acr s* 0+1; *dc s* 2+3, the last pair more developed; *pal s* 1; *b pprn s* 2; *anepst* 7; *b sctl s* with the same *ap sctl s* length

Legs. Fore tibia *d*, *pv* with apical seta. Mid femur *a* with a row of short setae in basal half; *v* with a row of setae in apical half; *p* with two setae in apical half. Mid tibia *p* with

median e supra median seta; *d*, *a*, *v* and *p* apical setae well developed. Hind femur *ad* with a complete row of long setae; *av* with a row (5) of long setae in apical half. Hind tibia *ad, av* with median seta; *d* and *av* with apical seta.

Wing. Vein R_1 dorsally with setulae on apical half; vein R_{4+5} dorsally with setulae beyond the crossvein r-m, apical portion of the vein M bent toward vein R_{4+5}; crossvein r-m almost straight.

Abdomen. First sternite bare.

Terminalia. Not examined.

Female. Unknown.

Type-material examined**.** Lectotype, male (Fig. 14D). "Peru \ 03. i. 04 \ Pichis-Weg [green hand-written label]"; "Coll. W. Schnuse\ 1911 - 3 [green printed label]";" Limnophora \ gracilitarsis \ sp nov [white hand-written label]"; "LECTOTYPE ♂ \ Limnophora\ gracilitarsis\ Stein, 1911 \ Des. A. C. Pont 1999 [white hand-written label]" (SMT). Paralectotype 1♂. Same locality 1. i. 04 1♂ (SMT).

Distribution. Mexico, Colombia, Peru and Bolivia.

Remarks. The lectotype is in good condition.

***Limnophora integra* Stein, 1911**

(Figs17A–D)

The complete reference list is available in de (Carvalho et al. 2005). After the catalogue: Pont 2013 (notes on type) Löwenberg-Neto & de Carvalho 2013 (check-list).

Redescription. Lectotype, male (Fig. 17A). Ground-color dark brown, with silvery pruinose. *Thorax* (Fig. 17C). black, scutum with two white conspicuous vittae become wider near scutellum. Calypters whitish, with more pigmented borders. Wing hyaline yellowish, slightly infuscate. *Legs*. brown.

Head (Fig. 17B). Holoptic, distance between the eyes almost null, eyes bare. *fr s* 7. Postpedicel about 3 times pedicel length. Arista long, bare.

Thorax chaetotaxy. *acr s* 0+0; *dc s* 2+3; *b pprn s* 2; *anepst* 7; *b sctl s* with the same *ap sctl s* length.

Legs. Fore tibia *d*, *pv* with apical seta. Mid femur *a* with a row of setae in basal half, *p* with two setae in apical half. Mid tibia *p* with supra median and median seta; *d*, *a*, *v* and *p* apical setae well developed. Hind femur *ad* and *av* with two setae in apical half. Hind tibia *ad, av* with median seta; *ad* and *av* with apical seta.

Wing. Vein R_1 dorsally setulose on apical half; apical portion of the vein M parallel with R_{4+5}; crossvein r-m almost straight.

Abdomen. Sternite1bare; sternite 5 trapezoid, longer than wide, with several setae, apical third membranous (Fig. 42A).

Male terminalia. Cercus (Fig. 42B) longer than wide, fused on middle, with incisions on proximal and distal part, proximal part with long setae on inner margin. Phallic complex (Fig. 42C), phallapodeme longer than pregonite, distal part no enlarged; epiphallus longer than postgonite, curved; hypandrium in plate-like; pregonite joined to hypandrium with setulae; postgonite curved with setulae and distal part membranous; distiphallus long, about 1.5 times the length of pregonite, distal part membranous.

Female. Similar to male. Distance between eyes about 0.30 the head width. *Fr s*3, less developed.

Type-material examined. Lectotype, male (Fig. 17D). “Bolivia \ 30. xi. 02 \ La Paz [green hand-written label]”; “Coll. W. Schnuse\ 1911 - 3 [green printed label]”; “LECTOTYPE ♂ \ Limnophora \ integra \ Stein, 1911 \ Des. A. C. Pont 1999 [green printed label]” (SMT). Paralectotypes 6♂ e 1♀. Same date as lectotype 1♂ (SMT); La Paz, 6. xii. 02,1♂ (ZMHU); Sorata, 2300, 20. xi. 02, 4♂ 1♀ (SMT).

Additional material examined. Chile, Palca, 20. x. 02, ♂ (SMT).

Distribution. Bolivia.

Remarks. The lectotype is in good condition.

***Limnophora laeta* Stein, 1911**

(Figs18A–D)

The complete reference list is available in de (Carvalho et al. 2005). After the catalogue: Pont 2013 (notes on type) Löwenberg-Neto & de Carvalho 2013 (check-list).

Redescription. Lectotype, male (Fig. 18A). Dark brown, with silvery pruinose. *Thorax* (Fig. 18B). black, with two conspicuous white vittae on prescutum and scutum with two conspicuous white vittae near base of scutellum. Calypters whitish. Wing hyaline yellowish, slightly infuscate. *Legs*. brown.

Head (Fig. 18C). Dichoptic. Distance between the eyes bigger than pedicel, eyes sparsely ciliated. *fr s* 7. Postpedicel about 1.5 times pedicel length. Arista long, pubescent with very short hairs.

Thorax chaetotaxy. *acr s* 0+1; *dc s* 2+4; first pair post sutural less developed, *b pprn s* 2; *anepst* 6; *b sctl s* with the same *ap sctl s* length.

Legs. Fore tibia *d*, *pv* with apical seta. Mid femur *a* with a row of setae in basal half, *v* with a row of setae in apical half. Mid tibia *p* with median seta; *d*, *a*, *v* and *p* apical setae well developed. Hind femur *ad* and *av* with a complete row of setae. Hind tibia *ad, av* with median seta; *ad* and *av* with apical seta.

Wing. Vein R_1 bare; apical portion of the vein M bent forward to R_{4+5}; crossvein r-m almost straight.

Abdomen. First sternite bare.

Terminalia. Not examined.

*Female***.** Unknown.

Type-material examined**.** Lectotype, male (Fig. 18D). “Chile \ 23. ix. 02 \ Coquimbo [green printed label, date hand-written]”; “Coll. W. Schnuse\ 1911 - 3 [green printed label]”; “LECTOTYPE ♂ \ Limnophora\ laeta\ Stein, 1911 \ Des. A. C. Pont 1999 [white printed label]” (SMT). Paralectotypes 1♂. Chile, Quilota, 20. ix. 02 1♂ (SMT).

Distribution. Chile.

Remarks. The lectotype is in good condition.

Limnophora lamasi Fogaça & de Carvalho, 2015

The complete description and photos are available in Fogaça & de Carvalho (2015) (Figs 25–30, pp. 216–217).

Diagnosis. *dc s* 0+1; *acr s* 0+0; vein R_1 dorsally setulose on apical half; vein R_{4+5} with setulae almost reaching the crossvein r-m; *a kepst s* 1+1 Fogaça & de Carvalho (2015).

Limnophora limbata (Bigot, 1885)

(Figs 43A–C)

The complete reference list is available in de (Carvalho et al. 2005). After the catalogue: Löwenberg-Neto & de Carvalho 2013 (check-list).

Notes. Nontype, female (5). Ground-color. dark brown, with silvery pruinose. *Thorax.* black, scutum with two white conspicuous vittae extending to apex of scutellum. Calypters whitish, with more pigmented borders. Wing hyaline yellowish. *Legs*. brown.

Head. Dichoptic. Distance between the eyes 0.30 width of head, eyes sparsely ciliated. *fr s* 6. Postpedicel about 2 times pedicel length. Arista long, pubescent.

Thorax chaetotaxy. *acr s* 0+1; *dc s* 2+4; first pair post sutural less developed, *b pprn s* 2; *anepst* 6; *b sctl s* with the same *ap sctl s* length.

Legs. Fore tibia *d*, *pv* with apical seta. Mid femur *a* with median setae. Mid tibia *p* with median seta; *d*, *a*, *v* and *p* apical setae well developed. Hind femur *ad* and *av* with a complete row of setae. Hind tibia *ad, av* with median seta; *ad* and *av* with apical seta.

Wing. Vein R_1 bare; apical portion of the vein M bent forward to R_{4+5}; crossvein r-m almost straight.

Female terminalia (Fig. 43A–C). Tergites 6 and 7 complete; tergite 8 divided dorsally. Sternites 6 and 7 narrows, plate-like; sternite 8 very reduced. Epiproct with conspicous setae. Hypoproct elongated, with spines apically and upward directed. Cercus globose with conspicuous setae. 3 spermathecae.

Male. Unknown.

Type-material examined. Not examined.

Additional material examined. Bolivia, Mapiri, Lorenzopata 29. iv. 03, 1♀ (SMT), 5. iv. 03, 1♀ (SMT), 22. iv. 03, 1♀ (SMT), 26. iv. 03, 1♀ (SMT), 12. iv. 03, 1♀ (SMT).

Distribution. Mexico and Chile.

Remarks. The specimens are in good condition.

Limnophora longivittata Fogaça & de Carvalho, 2015

The complete description and photos are available in Fogaça & de Carvalho (2015) (Figs 31–36, pp. 217–218).

Diagnosis. *dc s* 2+3; vein R_1 dorsally setulose on apical half; thorax dark brown with 2 conspicuous white vittae extending over scutellum Fogaça & de Carvalho (2015).

Limnophora lopesae Carvalho & Pont NOM. N.

(Figs 19A–D)

The complete reference list is available in de (Carvalho et al. 2005). After the catalogue: Löwenberg-Neto & de Carvalho 2013 (check-list).

Description. Holotype, male (Fig. 19B) and 4 paratypes males. Dark brown, with silvery pruinose. *Thorax* (Fig. 19C). black, scutum without vittae (Fig. X). Calypters whitish, with darkened margins. Wing infuscate. *Legs*. brown.

Head (Fig. 19A). Holoptic, distance between the eyes almost null, eyes bare. *fr s* 9. Postpedicel about 2 times pedicel length. Arista long, short pubescent.

Thorax chaetotaxy. *acr s* 0+1; *dc s* 2+4; *b pprn s* 2; *npl s* 2; *anepst* 6; *b sctl s* with the same *ap sctl s* length.

Legs chaetotaxy. Mid femur *a* with a row of setae in basal half; *p* with two setae in apical half, *pv* with four setae in basal half. Mid tibia *p* with two supra median and median seta; *ad*, *av*, *v* and *pv* with apical seta. Hind femur *ad* with a complete row of setae; *av* with six setae in apical half; *pv* with a row of setae in basal half. Hind tibia *ad, av* with four setae in median half; *d* and *av* with apical setae.

Wing. Vein R_1 dorsally setulose on apical half; apical portion of the vein M bent forward to R_{4+5}; crossvein r-m almost straight.

Abdomen. Sternite1bare; sternite 5 trapezoid, longer than wide, with several setae, apical third membranous and two stronger setae (Fig. 2; Lopes & Khouri 1989, p. 337).

Male terminalia. Cercus (Figs 3–4; Lopes & Khouri 1989, p. 337) length and width almost similar, fused on middle, with incisions on proximal and distal part, proximal part with long setae on inner margin. Phallic complex (Fig. X), phallapodeme longer than pregonite, distal part no enlarged; epiphallus longer than postgonite, curved; hypandrium in plate-like; pregonite joined to hypandrium with setulae; postgonite curved with setulae and distal part membranous; distiphallus long, about 2.5 times the length of pregonite, distal part membranous.

Female terminalia (Fig. 2; Lopes & Khouri 1989, p. 337). Hypoproct elongated, with spines apically and upward directed. Cercus globose with conspicuous setae.

Female. Not examined.

*Type-material examined***.** Holotype, male (Fig. 19D). “Petropolis - E. Rio \ Alto da Mosela 1. 100m, \ i/ ii/ de 1956 \ D. Albuquerque [white printed label, head detached and glued on label]”; “Holotipo [red printed label]”; “*Heliographa* \ *longiseta* [white hand-written label]”; “MNRJ \ 2096 [white printed label]” (MNRJ). Paratypes. 3♀ 2 ♂ same data as

holotype (MNRJ), 1♂ same locality, 24. vi. 195, D. Albuquerque col. (the date is no complete) (MNRJ), and 1♂ Serra da Bocaina, Parque de criação de Truta, Março – 1954, Dalcy & Rego Barros col. (MNRJ).

Remarks. The holotype is damage. Only are preserved some partes, thorax, wing and head. The paratypes are in good condition.

Distribution. Brazil.

***Limnophora marginata* Stein, 1904**

(Figs 45A–E)

The complete reference list is available in de (Carvalho et al. 2005). After the catalogue: Pont 2013 (notes on type) Löwenberg-Neto & de Carvalho 2013 (check-list), Pérez & de Carvalho 2016 (catalogue).

The complete description and photos are available in Fogaça & de Carvalho (2015) (Figs 1–6, p. 212).

Diagnosis. *dc s* 2+3; vein R_1 dorsally with conspicuous setulae on median half; Rs node and base of vein R_{4+5} setulose dorsally Fogaça & de Carvalho (2015).

***Limnophora marginipennis* Stein, 1911**

(Figs 20A–D)

The complete reference list is available in de (Carvalho et al. 2005). After the catalogue: Pont 2013 (notes on type) Löwenberg-Neto & de Carvalho 2013 (check-list).

Redescription. Lectotype, female (Fig. 20A). Ground-color. dark brown, with silvery pruinose. *Thorax* (Fig. 20C). Black, without vittae. Calypters whitish, with more pigmented borders. Wing brown, slightly infuscate. *Legs*. Brown.

Head (Fig. 20B). Dichoptic, distance between the eyes 0.30 width of head, eyes sparsely ciliated. *fr s* 6. Postpedicel about 2 times pedicel length. Arista long, pubescent.

Thorax chaetotaxy. *acr s* 0+1; *dc s* 2+4; first pair post sutural less developed, *b pprn s* 2; *anepst* 8; *b sctl s* with the same *ap sctl s* length.

Legs. Fore tibia *d*, *pv* with apical seta. Mid femur *a* and *v* with a row of setae in basal half, *p* with two setae o apical half. Mid tibia *p* with median and supra median seta; *d*, *a*, *v* and *p* apical setae well developed. Hind femur *ad* with a complete row of setae, *av* with a row of setae in apical half, *pv* with a row of setae in basal half. Hind tibia *ad, av* with median seta; *ad* and *av* with apical seta.

Wing. Vein R_1 bare, apical portion of the vein M bent forward to R_{4+5}; crossvein r-m almost straight.

Abdomen. Sternite1bare; sternite 5 trapezoid, longer than wide, with several long setae (Fig. 6; Lopes & Couri 1987, p. 649).

Male terminalia. Cercus (Figs 7–8; Lopes & Couri 1987, p. 649) longer than wide, fused on middle, with incisions on proximal and distal part, covered with long setae meanly on inner margin. Phallic complex (Figs 9–10; Lopes & Couri 1987, p. 649), phallapodeme longer than pregonite, distal part weakly enlarged; epiphallus longer than postgonite, curved; hypandrium plate-like; pregonite joined to hypandrium with setulae; postgonite curved with setulae; distiphallus long, about 1.5 times the length of pregonite, distal part membranous.

Female terminalia (Fig. 11; Lopes & Couri 1987, p. 649). Hypoproct elongated, upward directed, with spines apically; cercus globose with conspicuous setae.

Type-material examined. Lectotype, female (Fig. 20D), we have labelled the ♀ herewith as **lectotype.** Lectotype, female. “Peru \ 01. i. 04 \ Pichis-Weg [green printed label, date hand-written]”; “Coll. W. Schnuse\ 1911 - 3 [green printed label]”; “SYNTYPE ? ♀ \ Limnophora\ marginipennis\ Stein, 1911 \ Des. A. C. Pont 1999 [White printed label]”; “LECTOTYPE ♂ \ Limnophora\ marginipennis \ (Stein, 1911) \ Des. J. M. Fogaça and \ C. J. B de Carvalho 2019 [white printed label]” (SMT). Paralectotype. 1♀. Same locality as Syntype 3.i. 04 1♀ (SMT); 02. i. 04 1♀ (ZMHU).

Additional material examined. Bolivia, Mapiri 28. iv. 03, 1♀ (SMT).

Distribution. Nicaragua and Peru.

Remarks. The syntypes are in good condition.

***Limnophora minuscula* (Van der Wulp, 1896)**

(Figs 21A–C)

The complete reference list is available in de (Carvalho et al. 2005). After the catalogue: Pont 2013 (notes on type) Löwenberg-Neto & de Carvalho 2013 (check-list).

Redescription. Lectotype, male (Fig. 21A). Dark brown, with silvery pruinose. *Thorax* (Fig. 21C). black, with two white vittae on prescutum and scutum with two white vittae near base of scutellum. Calypters whitish, with darkened margins. Wing hyaline. *Legs*. brown.

Head (Fig. 21B). Dichoptic, distance between bigger than pedicel width, eyes sparsely ciliated. *fr s* 4 less developed. Postpedicel about 1,5 times pedicel length. Arista long, short plumose, apical half bare.

Thorax chaetotaxy. *acr s* 0+1; *dc s* 2+4, the first two postsutural less developed; *b pprn s* 2; *npl s* 2; *anepst* 6; *b sctl s* with the same *ap sctl s* length.

Legs chaetotaxy. Fore tibia *d*, *pv* with apical seta. Mid femur *a* with a row of short setae in basal half; *v* with a row of long setae in basal half; *p* with two setae in apical half. Mid tibia *p* with *a* median seta; *d*, *a*, *v*, *p* with apical seta. Hind femur *ad* with a complete row of long setae*; av* row of long setae in apical half. Hind tibia *ad,* and *av* with median seta; *d* and *av* with apical seta.

Wing. Vein R_1 bare; apical portion of the vein M bent forward to R_{4+5}; crossvein r-m almost straight.

Abdomen. First sternite bare.

Terminalia. Not examined.

Female. Similar to male, but *fr s* 3; *u orb s* 2. *o vt s* divergent; *i vt s* convergent. Dorsal vitta more conspicuous; pulvilli and claws reduced.

Type-material examined. Lectotype, Male (Fig. 21D) we have labelled the ♂ herewith as **lectotype**. “Syn \ Type [White printed label]”; “B. C. A. Dipt. II. \ Leucomelina \ minuscula, \ v. d. W. [white printed label]”; “Atoyac, \ Vera Cruz \ April. H. H. S. [white printed label]”; “Cent. America: \ F. D. Godman & \ O. Salvin. \ B. M. 1903 – 172. [white printed label]” “LECTOTYPE ♂ \ Limnophora\ minuscula \ (Van der Wulp, 1896) \ Des. J. M. Fogaça and \ C. J. B de Carvalho 2019 [white printed label]” (BMNH). 2♂ 6♀ Paralectotypes. Same data as Lectotype (BMNH).

Additional material examined. Same data as Lectotype 1♂ (BMNH). Corozal, Canal Zone, 19. I. 1929 1♂ (BMNH).

Distribution, Mexico and Nicaragua.

Remarks. the lectotype is in good condition, but the setae from head are lost.

***Limnophora narona* (Walker, 1849)**

(Figs 22A–D, 44A–C)

The complete reference list is available in de (Carvalho et al. 2005). After the catalogue: Löwenberg-Neto & de Carvalho 2013 (check-list).

Limnophora alacris Stein, 1911. **New synonymy**.

Redescription. Lectotype, male (Fig. 22A). Ground-color dark brown, with silvery-white pruinose areas. *Thorax* (Fig 22C). ground color black; scutum with 2 white narrows vittae, scutellum black. Calypteres whitish with more pigmented borders. *Legs*. brown.

Head (Fig. 22B). Holoptic, distance between the eyes almost null, eyes sparsely ciliated. *fr s* 6. Postpedicel about 2 times pedicel length. Arista long, pubescent, with very short cilia.

Thorax chaetotaxy. *acr s* 0+1; *dc s* 2+4, the first two postsutural less developed; *b pprn s* 2; *npl s* 2; *anepst* 6.

Legs chaetotaxy. Fore tibia *d* and *pv* with one apical seta. Mid femur *a* with a row of short setae in basal half and *v* with a row of long setae in median half; *p* two seat in apical

half. Mid tibia *p* a median seta; *d*, *a*, *v*, *p* one apical seta. Hind femur *ad* a complete row of long setae and *av* with a row of long apical half. Hind tibia *ad, av* with median half seta; *d* and *av* one apical seta.

Wings. Vein R_1 bare; apical portion of the vein M bent toward vein R_{4+5}; crossvein r-m slightly undulate.

Abdomen. Sternite1bare; sternite 5 trapezoid, longer than wide, with several setae, apical third membranous, with two long setae (Fig. 44A).

Male terminalia. Cercus (Fig. 44B) length and width almost similar, fused on middle, with incisions on proximal and distal part, proximal part with long setae on inner margin. Phallic complex (Fig. 44C), phallapodeme length similar to the pregonite, distal part no enlarged; epiphallus longer than postgonite, curved; hypandrium in plate-like; pregonite joined to hypandrium with setulae; postgonite curved with setulae and distal part membranous; distiphallus short, about 1.5 times the length of pregonite, distal part membranous.

Female. Similar to male, *fr s* 5. 1 upper orbital seta. Scutum white vitae stronger. Hind fêmur on posterior surface with only one *ad* row of setae.

Type-material examined. Lectotype, Male (Fig. 22D) we have labelled the ♂ herewith as **lectotype**. Male. “Bolivia \ 21.xii.02\ Sorata 2300m [green, printed label, date handwritten]”; “Coll. W. Schnuse\ 1911 - 3 [green, printed label]”; “Limnophora \ alacris \ [white, printed label, handwritten]”; “LECTOTYPE ♂ \ Limnophora\ narona \ (Walker, 1849) \ Des. J. M. Fogaça and \ C. J. B de Carvalho 2019 [white printed label]” (SMT). Paralectotypes 7 ♂ e 2 ♀. (same locality, 19. xii. 02, 2♂ (SMT, ZMHU); 20. xii. 02, 2♂ e 1 ♀ (SMT); 21. xii.02, 1♂ e 1♀ (SMT); 22. xii. 02, 2♂ (SMT, ZMHU).

(Bolivia, Sorata, 2300m, 19. xii. 1902, 2♂ (SMT e ZMHU); same locality, 20.xii.1902, 2♂ (SMT e ZMHU).

Commentary. The lectotype is in good condition.

Distribution. Bolivia.

Remarks. After analysis of the type material, additional material and terminalia for the *Limnophora narona* and *L. alacris*, we conclude that the species are the same entity.

***Limnophora nigrargentata* Albuquerque, 1954**

(Figs 23A–E)

The complete reference list is available in de (Carvalho et al. 2005). After the catalogue: Löwenberg-Neto & de Carvalho 2013 (check-list).

Redescription. Paratype, male (Fig. 23A). Ground-color dark brown, with silvery pruinose areas. *Thorax* (Fig. 23C). black, without vitta. Calypters whitish, with more pigmented borders. Wing brown slight infuscate. *Legs*. Dark brown.

Head (Figs 23B, D). Holoptic, distance between the eyes almost null, eyes bare. *fr s* 7. Postpedicel about 2 times pedicel length. Arista long, pubescent, with very short cilia.

Thorax chaetotaxy. *acr s* 0+1; *dc s* 2+4; *b pprn s* 2; *anepst* 6; *b sctl s* was damaged in the paratype.

Legs chaetotaxy. Fore tibia *av* with one apical seta. Mid femur *a* with a row of setae in median half; *v* with a one seta in basal half; *p* with two setae in apical half. Mid tibia *p* with two median setae; *p*, *v*, with one apical seta. Hind femur *ad* with a complete row of long setae, *av* with a row of setae in apical half. Hind tibia *ad, av* with a median seta; *d* and *av* with one apical seta.

Wing. Vein R_1 bare; apical portion of the vein M bent toward vein R_{4+5}; crossvein r-m slightly undulate.

Abdomen. Sternite1bare; sternite 5 trapezoid, longer than wide, with several setae, apical third membranous and two stronger setae (Fig. 22; Albuquerque 1954, p. 408).

Male terminalia. Cercus (Fig. 18; Albuquerque 1954, p. 408) longer than wide, fused on middle, with incisions on proximal and distal part, proximal part with long and stronger setae on inner margin. Phallic complex (Fig. 22; Albuquerque 1954, p. 408), phallapodeme length similar to the pregonite, distal part no enlarged; epiphallus longer than postgonite, curved; hypandrium in plate-like; pregonite joined to hypandrium with setulae; postgonite curved with setulae and distal part membranous; distiphallus long, about 2.0 times the length of pregonite, distal part membranous.

Female. Not examined.

Type-material examined. Holotype, male (Fig. 23E). "Parque Nacional \ da Serra dos Orgãos \ Teresópolis 1500-1700m \ 14-22. 4. 1947 Wygod. col [White printed label]"; "Holotipo ♂ [red printed label]"; "Sylliminophora \ nigrargentata (alb) \ S. M. Lopes det. [white label, partially hand-written]"; "Heliographa \ nigrargentata \ sp. nov. \ D. Albuquerque det. [white handwritten label]"; "4657 [white hand-written label]" (MNRJ).

Distribution. Brazil and Argentina.

Remarks. The holotype ♂ is in good condition.

***Limnophora ovativentris* Macquart, 1851**

(Figs24A–D)

The complete reference list is available in de (Carvalho et al. 2005). After the catalogue: Pont 2012 (notes on type) Löwenberg-Neto & de Carvalho 2013 (check-list).

Resdescription. Paratype, male (Fig. 24A). Dark brown, with silvery pruinose. *Thorax* (Fig. 24C). black, with a narrow gray vitta along planes of dorsocentral seta which extends to base of scutellum. Calypters whitish, with darkened margins. Wing hyaline yellowish. *Legs*. dark brown.

Head (Fig. 24B). Holoptic, distance between the eyes about 0.10 the width of the head, eyes bare. *fr s* 8. *i vt s* and *o vt s* are damaged in the paratype. Postpedicel about 2 times pedicel length. Arista long, pubescent, with very short cilia.

Thorax chaetotaxy. *acr s* 0+1; *dc s* 2+3; *b pprn s* 4, two less developed; *npl s* 2; *anepst* 5; *b sctl s* was damaged in the paratype.

Legs chaetotaxy. Fore tibia *d*, *pv* with apical seta. Mid femur *a* with 2 long setae in median half; *v* with a row of (7) long setae in basal half; *p* with to setae in apical half. Mid tibia *p* with 2 median setae; *p* and *v* with apical seta. Hind femur *ad* with a complete row of long setae, *av* with a row of long setae in apical half. Hind tibia *ad* and *av* with seta in median half; *d* and *av* with apical seta.

Wing. Vein R_1 was damaged in the paratype; apical portion of the vein M bent forward to R_{4+5}; crossvein r-m almost straight.

Abdomen. First sternite bare.

Terminalia. Not examined.

Female. not examined.

Type-material examined. Lectotype, male (Fig. 24D). “MNHN, Paris \ ED8537 [white printed label]”; “LECTOTYPE [red printed label]”; “TYPE [red printed label]”; “9522 \ 34 [white hand-written label]”; “26 [white hand-written label]”; “Anthomyia \ ovativentris \ ♂. Macq. n. sp. [white hand-written label]”; “Gymnodia [green hand-written label]”; “LECTOTYPE ♂ \ designated by \ Albuquerque \ 1950 [printed and hand-written label]”. (MNHN).

Distribution. Uruguay.

Remarks. More information see Pont 2012.

***Limnophora paranaensis* Albuquerque, 1954**

(Figs 25A–E, 37)

The complete reference list is available in de (Carvalho et al. 2005). After the catalogue: Löwenberg-Neto & de Carvalho 2013 (check-list).

Limnophora altaneira Albuquerque, 1954. **New synonymy.**
Limnophora paulistana Lopes & khouri, 1991. **New synonymy.**
Redescription. Holotype, male (Fig. 25A). Ground-color Dark brown, with silvery pruinose.

Thorax (Fig. 25C). Black, without vitta. Calypters whitish, with darkened margins. Wing hyaline brownish. *Legs*. dark brown. *Legs*. light brown. *Abdomen.* dissected.

Head (Figs 24B, D). Holoptic, distance between the eyes almost null, eyes bare. *fr s* 7. Postpedicel about 2 times pedicel length. Arista long, pubescent, with very short cilia.

Thorax chaetotaxy. *acr s* 0+0; *dc s* 2+5, the first three less developed; *b pprn s* 2; *anepst* 5; *b sctl s* was damaged in the holotype.

Legs. Fore tibia *d*, *pv* with one apical seta. Mid femur on *a* with a row of long setae on basal half. Mid tibia on *p* with two median setae; *d, av, v, pv* with one apical seta. Hind leg lost.

Wing. Vein R_1 dorsally with setulae on apical half; apical portion of the vein M bent toward vein R_{4+5}; crossvein r-m almost straight.

Abdomen. Sternite1bare; sternite 5 trapezoid, longer than wide, with several setae, apical third membranous and two stronger setae (Fig. 9; Albuquerque 1954, p. 400).

Male terminalia. Cercus (Fig. 5; Albuquerque 1954, p. 398) longer than wide, fused on middle, with incisions on proximal and distal part, proximal part with long and stronger setae on inner margin. Phallic complex (Figs 7–8; Albuquerque 1954, p. 399), phallapodeme longer than pregonite, distal part no enlarged; epiphallus longer than postgonite, curved; hypandrium in plate-like; pregonite joined to hypandrium with setulae; postgonite curved with setulae and distal part membranous; distiphallus long, about 2.0 times the length of pregonite, distal part membranous.

Female. Unknown.

*Type-material examined***.** Holotype, male (Fig. 25A): “Iguassú \ Paraná xii - 941 \ Com. E.N. V. [white printed label]”; “Holotipo [red printed label]”; “Syllimnophora \ paranaensis alb. \ S. M. Lopes det. [white printed label, partially hand-written, S. M. = Sonia Maria]”; “Heliographa \ paranaensis sp.n. \ D. Albuquerque det. [white printed label, partially hand-written]”; “4612”, (MNRJ). Paratype 1 ♂ same data as holotype.

Additional material examined. 13♂, Brazil, Paraná, Iguassu, xii. 941, Com. E.N.V. (MNRJ); 1♂, Rio de Janeiro, 18. viii. 1946 (MNRJ); 1♂, Petropolis, 19.ii.72, H. S. Lopes. (MNRJ).

Distribution. Honduras, Belize, Venezuela and Brazil.

Remarks. The holotype male is without abdomen and mid and hind right legs. The sternite 5, cercus and phallic complex are preserved on plate. Albuquerque (1954), when described *Limnophora altaneira* and *L paranaensis*, in the same study, he emphasized that species are very similar, and after analysis of the type material, additional material and terminalia for the *Limnophora altaneia*, *L. paulistana and L. paranaensis*, we conclude that the species are the same entity.

***Limnophora patagonica* Malloch, 1934**

(Figs26A–D, 27A–D)

The complete reference list is available in de (Carvalho et al. 2005). After the catalogue: Löwenberg-Neto & de Carvalho 2013 (check-list), Gomes et al. 2018 (distribution).

Redescription. Nontype, male (Fig. 26A). Dark brown, with silvery pruinose. *Thorax* (Fig. 26C). black, prescutum with two white narrow vittae along planes of dorsocentral, prescutum with two vittae seta which extends to base of scutellum. Calypters brownish, with darkened margins. Wing hyaline brownish. *Legs*. brown.

Head (Fig. 26B). Dichoptic, distance between the eyes bigger than pedicel width, eyes sparsely ciliated. fr s 6. Postpedicel about 2 times pedicel length. Arista long, short pubescent on basal half.

Thorax chaetotaxy. *acr s* 0+1; *dc s* 2+4, the first two postsutural less developed; *b pprn s* 2; *anepst* 6. *b sctl s* with the same *ap sctl s* length.

Legs. Fore tibia without median; *d* and *pv* apical setae. Mid femur with row of short setae in basal half; *v* white row of long setae in basal half; *p* with two setae in apical half. Mid tibia *p* with median seta; *d*, *a*, *v*, *p* with apical seta. Hind femur *ad*, *pv*, *av* with complete row of long setae. Hind tibia *ad*, *av* with seta in median half; *d* and *av* with apical seta.

Wing: Vein R1 bare; Vein R4+5 gradually curved forward apically; vein r-m slightly undulate.

Abdomen. Sternite1bare; sternite 5 trapezoid, longer than wide, with several long setae, meanly on center part (Fig. 13; Lopes & Couri 1987, p. 650).

Male terminalia. Cercus (Figs 14–15; Lopes & Couri 1987, p. 650) wider than long, fused on middle, with incisions only in distal part, covered with long stronger setae on inner margin. Phallic complex (Figs 16–17; Lopes & Couri 1987, p. 650), phallapodeme longer than pregonite, distal part not enlarged; epiphallus longer than postgonite, curved; hypandrium plate-like; pregonite joined to hypandrium with setulae; postgonite curved with setulae; distiphallus long, about 1.5 times the length of pregonite.

Female. Similar to male (Figs 27A–C), *fr s* 6; *u orb s* 2. *o vt s* divergent; *i vt s* convergent. Dorsal vitta more conspicuous. Hind femur *av* with row (3) of setae in apical half.

Type-material examined. Allotype, female (Fig. 27D): “Uruguay \ Montevideo. \ 17.x.1926\ F. & M. Edwards \ B. M. 1927 - 63. [white printed label]”; “Limnophora \ patagonica \ det. JR Malloch [white, printed label and partially handwritten]” (BMNH).

Additional material examined. Argentina, La Plata, Punta Lara, 13. i. 1970. Malaise trap. Vardy & Arguindeguy B. M. 1970 – 36, 5♂ and 7 ♀ (BMNH).

Distribution. Chile, Argentina, Uruguay.

Remarks: The allotype is in good condition.

***Limnophora penai* Fogaça & de Carvalho, 2015**

(Figs 46A–F)

The complete description and photos are available in Fogaça & de Carvalho (2015) (Figs 37–42, pp. 218–219).

Diagnosis. *dc s* 2+3; vein R_1 dorsally setulose on apical half; Rs node setulose and vein R_{4+5} dorsally setulose beyond crossvein r-m Fogaça & de Carvalho (2015).

***Limnophora pica* Macquart, 1851**

(Figs 28A–D)

The complete reference list is available in de (Carvalho et al. 2005). After the catalogue: Pont 2012 (notes on type), Löwenberg-Neto & de Carvalho 2013 (check-list).

Redescription. Lectotype, male (Fig. 28A). Dark brown, with silvery pruinose. *Thorax* (Fig. 28C). Black, scutum with two white conspicuous vittae become wider near scutellum. Calypters brownish, with darkened margins. Wing hyaline brownish. *Legs*. Dark brown.

Head (Fig. 28B). Holoptic, distance between the eyes almost null, eyes bare. Postpedical about 1,5 times pedicel length. Arista long, short pubescent.

Thorax chaetotaxy. *acr s* 0+1; *dc s* 2+4, the first two postsutural less developed; *b pprn s* 2; *npl s* 2; *anepst* 6; *b sctl s* with the same *ap sctl s* length

Legs chaetotaxy. Fore tibia *d* with apical seta. Mid femur *pv* with 4 stout seta in median half; *p* with two setae in apical half. Mid tibia *p* with median seta; *d*, *a*, *v*, *p* with apical seta. Hind femur *ad* with a complete row of long setae; *av* with two setae in apical half; *pv* with a row of long, fine, setae in basal to median half. Hind tibia *ad, av* with seta in median half; *d* and *av* with apical setae.

Wing. Vein R_1 bare; apical portion of the vein M bent forward to R_{4+5}; crossvein r-m almost straight.

Abdomen. Sternite1bare;

Male terminalia. Not examined.

Female terminalia. Not examined.

Type-material examined. Lectotype, male (Fig. 28D). “MNHN, Paris \ ED8509 [white printed label]”; “LECTOTYPE [red printed label]”; “4 \ 44 [white hand-written label]”; “35 [white hand-written label, wing detached and glued on label]”; [Paralectotype ♂ \ des: Albuquerque \ 1950, Bolivia Mus. \ Nac. R. de J., \ Zool. 98:2 [white hand-written label]” (MNHN).

Distribution. Brazil and Argentina.

Remarks. The lectotype is in bad condition (Pont 2012).

***Limnophora piliseta* Stein, 1911**

(Figs 29A–D, 30A–C, 47A–D)

The complete reference list is available in de (Carvalho et al. 2005). After the catalogue: Pont 2013 (notes on type) Löwenberg-Neto & de Carvalho 2013 (check-list).

Limnophora spreta Malloch 1921. **New synonymy.**
Limnophora snyderi Lopes & Couri, 1987. **New synonymy.**

Redescription. Lectotype, male (Fig. 29A). Dark brown, with silvery pruinose. *Thorax* (Fig. 29C). black, with white pruinose on prescutum, scutum and scutellum. Calypters whitish, with darkened margins. Wing hyaline yellowish. *Legs*. brown.

Head (Fig. 29B). Holoptic, distance between the eyes almost null, eyes sparsely ciliated (Fig. 47D). *fr s* 6. Postpedicel about almost 3 times pedicel length. Arista long, plumose.

Thorax chaetotaxy. *acr s* 0+1; *dc s* 2+4, the first two postsutural less developed; *b pprn s* 2; *anepst* 6; *b sctl s* with the same *ap sctl s* length.

Legs. Mid femur *a* with a row of short setae in basal half; *v* with a row of long setae in basal half; *p* with two setae in apical half. Mid tibia *p* with median seta; *d*, *a*, *v*, *p* with apical seta. Hind femur *ad* and *av* with a complete row of long setae; *pv* with a row of long setae in basal half. Hind tibia *ad, av* with seta in median half; *d* and *av* with apical seta.

Wing. Vein R_1 dorsally with setulae on apical half; apical portion of the vein M bent forward to R_{4+5}; crossvein r-m almost straight.

Abdomen. First sternite with a few setulae; sternite 5 trapezoid, longer than wide, with several long setae (Fig. 18; Lopes & Couri 1987, p. 652).

Male terminalia. Cercus (Figs 19–20; Lopes & Couri 1987, p. 652) almost round, fused on middle, with incisions on proximal and distal part, covered with long setae meanly on inner margin. Phallic complex (Figs 9–10; Lopes & Couri 1987, p. 652), phallapodeme longer than pregonite, distal part weakly enlarged; epiphallus longer than postgonite, curved; hypandrium plate-like; pregonite joined to hypandrium with setulae; postgonite curved with setulae; distiphallus long, about 1.5 times the length of pregonite.

Female (Fig. 30A). Similar to male, but dichoptic (Fig. 30B) *fr s* 4; *u orb s* 1. *o vt s* divergent; *i vt s* convergent. Dorsal vitta more conspicuous (Fig. 30C). Hind femur 1 complete row of long *ad*, *av* 1 seta on apical half.

Female terminalia (Fig. 11; Lopes & Couri 1987, p. 652). Hypoproct elongated, upward directed, with spines apically; cercus with long setae.

Type-material examined. Lectotype, male (Fig. 29D). “Peru – 150m \ 6.11.03 \ Pachitea-Münd. [green printed label]”; “[Coll. W. Schnuse \ 1911 - 3 [green printed label]”; “LECTOTYPE ♂ \ Limnophora\ plumiseta \ Stein, 1911 \ Des. A. C. Pont 1999[White printed label]” (SMT). Paralectotype. same data as Lectotype, 1♂ (SMT).

Additional material examined. Bolivia, Mapiri, 29. Vii. 02, 1 ♀ (SMT).

Distribution. Mexico, Guatemala, Honduras, El Salvador, Nicaragua, Costa Rica, Panama, Venezuela, Guyana, Colombia, Peru, Brazil and Argentina.

Remarks. Lectotype is in good condition. after analysis of the type material, additional material and terminalia for the *Limnophora snyderi and L. spreta*, we conclude that the species are the same entity.

Limnophora polleti Fogaça & de Carvalho, 2015

The complete description and photos are available in Fogaça & de Carvalho (2015) (Figs 43–48, p. 220).

Diagnosis. *dc s* 2+4; vein R_1 dorsally setulose on apical half; Rs node setulose and vein R_{4+5} dorsally setulose almost reaching apex, meron and sternite 1 setulose Fogaça & de Carvalho (2015).

Limnophora pura Stein, 1911

(Figs 31A–D)

The complete reference list is available in de (Carvalho et al. 2005). After the catalogue: Pont 2013 (notes on type) Löwenberg-Neto & de Carvalho 2013 (check-list).

Description. Lectotype, male (Fig. 31A). Dark brown, with silvery pruinose. *Thorax* (Fig. 31C). black, scutum with two white conspicuous vittae become wider near scutellum. Calypters whitish, with darkened margins. Wing hyaline brownish. *Legs*. brown.

Head (Fig. 31B). Holoptic, distance between the eyes almost null, eyes sparsely ciliated. *fr s* 9. Postpedicel about 2 times pedicel length. Arista long, pubescent.

Thorax chaetotaxy. *acr s* 0+1; *dc s* 2+3; *b pprn s* 2; *npl s* 2; *anepst* 6; *b sctl s* with the same *ap sctl s* length.

Legs chaetotaxy. Fore tibia *d*, *pv* with apical seta. Mid femur *v* with two setae in basal half; *p* with two setae in apical half. Mid tibia *p* with median seta; *d*, *a*, *v*, *p* and *pv* with apical seta. Hind femur *ad* with a complete row of setae; *av* with a row of setae in apical half; *pv* with a row of setae in basal half. Hind tibia *ad, av* with seta in median half; *d* and *av* with apical setae.

Wing. Vein R_1 dorsally setulose on apical half; apical portion of the vein M bent forward to R_{4+5}; crossvein r-m almost straight.

Abdomen. First sternite bare.

Terminalia. Not examined.

Female. Not examined.

Type-material examined. Lectotype, male (Fig. 31D). "Peru- Laristhal \ 10.viii.03\ 2-3000m [green printed label, date hand-written]"; "Coll. W. Schnuse\ 1911 - 3 [grenn printed label]"; "LECTOTYPE ♂ \ Limnophora\ pura \ Stein, 1911 \ Des. A. C. Pont 1999 [white printed label]" (SMT). Paralectotype 1 ♂ Peru, Tarma, 19. i. 04, 1♂, whitout head (SMT).

Distribution. Peru, Brazil, Chile and Argentina.

Remarks. The lectotype is in good condition.

***Limnophora saeva* Wiedemann, 1830**

(Figs 32A–D, 48A–E)

The complete reference list is available in de (Carvalho et al. 2005). After the catalogue: Löwenberg-Neto & de Carvalho 2013 (check-list).

Redescription. Lectotype, male (Fig. 32A). Dark brown, with silvery pruinose. *Thorax* (Fig. 32C). dark brown, with two white vittae near transverse suture. Calypters whitish, with darkened margins. Wing hyaline yellowish. *Legs*. dark brown.

Head (Fig. 32B). Holoptic. distance between the eyes almost null, eyes bare. *fr s* 6. Postpedicel about 2 times pedicel length. Arista long, plumose.

Thorax chaetotaxy. *acr s* 0+1; *dc s* 2+4, the last two pair postsutural more developed; *b pprn s* 2; *npl s* 2; *anepst* 6; *b sctl s* with the same *ap sctl s* length.

Legs chaetotaxy. Fore tibia *d*, *pv* with apical seta. Mid femur *v* with a row of setae in basal half; *p* with two setae in apical half. Mid tibia *p* with median seta; *d*, *a*, *v*, *p* and *pv* with apical seta. Hind femur *ad* with a complete row of setae; *av* with a row of setae in apical half;

pv with a row of setae in basal half. Hind tibia *ad, av* with seta in median half; *d* and *av* with apical setae.

Wing. Vein R_1 bare; apical portion of the vein M bent forward to R_{4+5}; crossvein r-m almost straight.

Abdomen. Sternite1bare; sternite 5 trapezoid, longer than wide, with several setae, apical third membranous (Fig. 24; Couri & Lopes 1987, p. 653).

Male terminalia. Cercus (Fig. 25; Couri & Lopes 1987, p. 653) longer than wide, fused on middle, with incisions on proximal and distal part, proximal part with long setae on inner margin. Phallic complex (Figs 31–32; Couri & Lopes 1987, p. 653), phallapodeme longer than pregonite, distal part no enlarged; epiphallus longer than postgonite, curved; hypandrium in plate-like; pregonite joined to hypandrium with setulae; postgonite curved with setulae and distal part membranous; distiphallus long, about 2.0 times the length of pregonite, distal part membranous.

Female. Not examined.

Type-material examined. Lectotype, male (Fig. 32D). “saeva [hand] \ Coll. Wiedem. [white printed label]”; “ld [gray hand-written label]”; “A. saeva m. \ Brasilia [white hand-written label]”; [Lectotype ♂ \ designated by \ A. C. Pont 1981 \ Anthomyia \ saeva \ Wiedemann [White printed and hand-written label]” (NMW).

Additional material examined. Only males. 4 specimens with only two labels. “Brasilia” “saeva \ Coll. Winthem”. 4 specimens with only one label “Coll. Winthem”. 1 specimen with two labels “Bilimek \ Mexico 1883”; “Limnophora \ similis \ saeva Wied.”, this specimen has the gena more developed, but all character make it belongs to *Limnophora saeva.*

Distribution. Mexico, Guatemala, Costa Rica, Panama, Venezuela, Guyana, Ecuador, Peru, Bolivia, Brazil, Argentina

Remarks. The lectotype is in a good condition.

***Limnophora vicaria* Walker, 1853**

(Figs 33A–D)

The complete reference list is available in de (Carvalho et al. 2005). After the catalogue: Löwenberg-Neto & de Carvalho 2013 (check-list).

Notes. Holotype, female (Fig. 33A). The holotype is totally sniffed, being possible to see the wing and the head that is separated and glued in a plate (Fig. 33B).

Type-material examined. Holotype, female (Fig. 33D). "Holo \ type [white printed label]"; "vicaria [white hand-written]"; "Brazil \ W. W. Faunders \ B. M. 1868-4 [white hand-written label]"; "68.4[white printed label]"; "Holotype ♀ \ Anthomyia \ vicarial Walker \ 1852. ins. Sannd[cf.] \ I, Dipt 4: 36. [white hand-written label]"; (BMNH).

Distribution. Brazil.

Remarks. The lectotype is in a bad condition.

***Limnophora virgata* Wiedemann, 1830**

(Figs 34A–D)

The complete reference list is available in de (Carvalho et al. 2005). After the catalogue: Löwenberg-Neto & de Carvalho 2013 (check-list).

Redescription. Lectotype, female (Fig. 34A). Ground-color dark brown, with silvery pruinose. *Thorax* (Fig. 34C). black, scutum with two narrows white vitta extending to scutellum apex Calypters whitish. Wing hyaline. *Legs*. brown.

Head (Fig. 34B). Dichoptic. Distance between the eyes 0.30 width of head, eyes bare. *fr s* 4; Antennae inserted on middle of eyes, postpedicel about 2 times pedicel length. Arista long, plumose.

Thorax chaetotaxy. *acr s* 0+1; *dc s* 2+4; first pair post sutural less developed, *b pprn s* 2; *anepst* 8; *b sctl s* and *sctl s* damage.

Legs. Fore tibia *d*, *pv* with apical seta. Mid femur *p* with two setae o apical half. Mid tibia *p* with median seta; *d*, *a*, *v* and *pv* apical setae well developed. Hind femur *ad* with a complete row of setae, *av* with a of seta in apical half. Hind tibia *ad, av* with median seta; *ad* and *av* with apical seta.

Wing. Vein R_1 bare; apical portion of the vein M bent forward to R_{4+5}; crossvein r-m almost straight.

Terminalia. Not examined.

Male. Unknown.

Type-material examined. Lectotype, female (Fig. 34D). "Brasilia [white hand-written]"; "virgata \ Coll. Winthem [white hand-written label]"; "virgate wied. \ Brazilia [white hand-written]"; "Holotype ♀ \ Anthomyia \ virgate \ virgata \ Wiedemann \ det. A. C. Pont 1981 [white hand-written label"; "LECTOTYPE ♀ \ designated by\ A. C. Pont 1992 \ A. C. Pont 1992 \ Anthomyia \ virgate \Wiedemann [white printed label]" (NMW).

Distribution. Brazil.

Remarks. The Lectotype is in a good condition.

***Limnophora vittatum* Macquart, 1851**

(Figs 35A–D, 36A–D)

The complete reference list is available in de (Carvalho et al. 2005). After the catalogue: Pont 2012 (notes on type), Löwenberg-Neto & de Carvalho 2013 (check-list).

Redescription. Lectotype, male (Fig. 35A). Dark brown, with silvery pruinose. *Thorax* (Fig. 35C). black, without vitta. Calypters brownish, with darkened margins. Wing hyaline brownish. *Legs*. Brown.

Head (Fig. 35A). Damage.

Legs. Fore tibia *d*, *pv* with apical seta. Hind femur on *ad, av* with a complete row of long setae; *pv* row (4) of long setae on basal to median half. Hind tibia on *ad, av* with a seta on median half; *d* and *av* with apical seta.

Wing. apical portion of the vein M bent forward to R_{4+5}; crossvein r-m almost straight.

Abdomen. First sternite bare.

Paralectotype, female (Fig. 35A). Dark brown, with silvery pruinose. *Thorax* (Fig. 35C). Black, with a narrow gray vitta along planes of dorsocentral seta which extends to apex of scutellum

Head (Fig. 35B). dichoptic. Distance between the eyes 1/3 of head width, eyes sparsely ciliated. *fr s* 4; *pc orb s* absent; *u orb s 2*; *oc s* pair well developed; *poc s* smaller than *oc s*; *i vt s* convergent, with the same length of *oc s*; *o vt s* divergent with the same length of *i vt s*; Antennae inserted on middle of eyes, Postpedicalabout 2,5 times pedicel length. Arista long, long pubescent.

Thorax chaetotaxy. *acr s* 0+1; *dc s* 2+4, the first two postsutural less developed; *b pprn s* 2; *npl s* 2; *anepst* 6; *b sctl s* with the same *ap sctl s* length

Legs chaetotaxy. Fore tibia *d*, *pv* with apical seta. Mid femur *a* with one stout seta in median half; *p* with two setae in apical half. Mid tibia *p* with median seta; *d*, *a*, *v*, *p* with apical seta. Hind femur *ad* with a complete row of long setae; *av* with two setae in apical half; *pv* with a row of long, fine, setae in basal to median half. Hind tibia *ad, av* with seta in median half; *d* and *av* with apical setae.

Wing. Vein R_1 bare; apical portion of the vein M bent forward to R_{4+5}; crossvein r-m almost straight.

Abdomen. Sternite1bare; sternite 5 trapezoid, longer than wide, with several long setae (Fig. 28; Lopes & Couri 1987, p. 653).

Male terminalia. Cercus (Figs 29–30; Lopes & Couri 1987, p. 653) almost round, fused on middle, with incisions on proximal and distal part, covered with long setae meanly on inner margin. Phallic complex (Figs 31–32; Lopes & Couri 1987, p. 653), phallapodeme longer than pregonite, distal part not enlarged; epiphallus longer than postgonite, curved;

hypandrium plate-like; pregonite joined to hypandrium with setulae; postgonite curved with setulae; distiphallus long, about 2.0 times the length of pregonite.

Female terminalia (Fig. 27; Lopes & Couri 1987, p. 653). Hypoproct elongated, upward directed, with spines apically; cercus elongate, with conspicuous setae.

Type-material examined. Lectotype, male (Fig. 35D). "MNHN, Paris \ ED8509 [white printed label]"; "LECTOTYPE [red printed label]"; "4 \ 44 [white hand-written label]"; "35 [white hand-written label, wing detached and glued on label]"; [Paralectotype ♂ \ des: Albuquerque \ 1950, Bolivia Mus. \ Nac. R. de J., \ Zool. 98:2 [white hand-written label]" (MNHN).

Distribution. Brazil and Argentina.

Remarks. The lectotype is in bad condition, the paralectotype is in a good condition. see more information (Pont 2012)

Unplaced Species of *Limnophora* s. lat

***Limnophora iniqua* Stein, 1911**

(Figs 15A–D, 16A–D, 43A–F)

The complete reference list is available in de (Carvalho et al. 2005). After the catalogue: Pont 2013 (notes on type) Löwenberg-Neto & de Carvalho 2013 (check-list).

Redescription. Lectotype, male (Fig. 15A). Dark brown, with silvery pruinose. Frontal vitta, on posterior view black. *Thorax* (Fig. 15B). Black, scutum with two white vittae extending to apex of scutellum. Calypters whitish, with more pigmented borders. Wing hyaline brownwish, slightly infuscate. *Legs*. brown.

Head (Fig. 15C). Dichoptic, distance between the eyes 0.33 head width, eyes bare. *fr s* 3; Postpedicel about 3 times pedicel length. Arista long, pubescent, almost bare.

Thorax chaetotaxy. *acr s* 0+1; *dc s* 2+3; *b pprn s* 2; *anepst* 5; *b sctl s* with the same *ap sctl s* length.

Legs. Fore tibia *d*, *pv* with apical seta; fore tarsus *d* with projections. Mid femur *p* with two setae in apical half. Mid tibia *p* with median seta; *d*, *a*, *v* and *p* apical setae well developed. Hind femur *ad* and *av* with two setae in apical half. Hind tibia *ad, av* with median seta; *ad* and *av* with apical seta.

Wing. Vein R_1 bare; apical portion of the vein M parallel with R_{4+5}; crossvein r-m almost straight.

Abdomen. Sternite1bare; sternite 5 trapezoid, longer than wide, with setae, apical third membranous, the distal lateral protuberance well developed (Fig. 41A).

Male terminalia. Cercus (Fig. 41B) longer than wide, fused on middle, with incisions on proximal and distal part, proximal part with setae on inner margin. Phallic complex (Fig. 41C), phallapodeme longer than pregonite, distal part weakly enlarged; epiphallus longer than postgonite, curved; hypandrium in plate-like; pregonite joined to hypandrium with setulae; postgonite curved with setulae and distal part membranous; distiphallus short, similar the length of pregonite.

Female (Fig. 16A). Similar to male. Two pairs of *fr s* less developed (Fig. 15C).

Type-material examined. Lectotype, male (Fig. 15D). “Chile \ 12. ix. 02 \ Valparaiso [green hand-written label]”; “Coll. W. Schnuse\ 1911 - 3 [green printed label]”; “LECTOTYPE ♂ \ Calliophrys \ iniqua \ Stein, 1911 \ Des. A. C. Pont 1999 [white printed label]” (SMT). Paralectotypes 6♂ e 4♀. Same date as lectotype 1♂ (SMT); Chile, Tacna, 22. x. 02, 2♀ (SMT e ZMHU); Arica, 10. x. 02, 2♂ 2♀ (SMT e ZMHU); Palca,20. x. 02, 1♂ (SMT). Peru, Arequipa, 13. xi. 02, 1♂ (SMT); Sicuani, 20. vi. 03, 1♂ (SMT).

Additional material examined. Peru, Sicuani, 18. vi. 03, 1♀ (SMT).

Distribution. Peru and Chile.

Remarks. The lectotype is in good condition.

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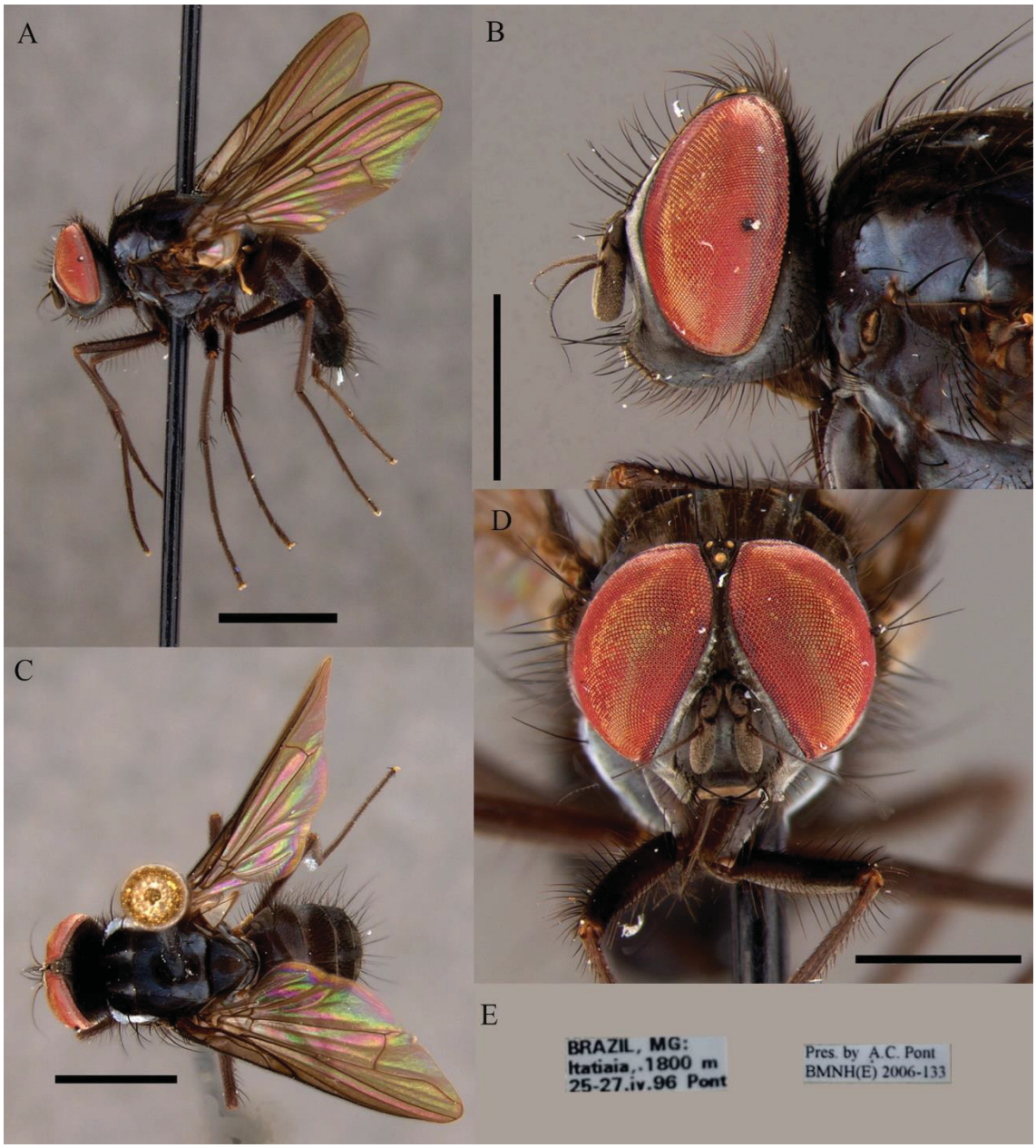

FIGURE 1. *Limnophora* **sp**. **nov**. **1**. Holotype. Male: **A.** Habitus, lateral view. **B**. Head, lateral view. **C**. Thorax, dorsal view. **D.** Head, frontal view. Scale bars: 1mm

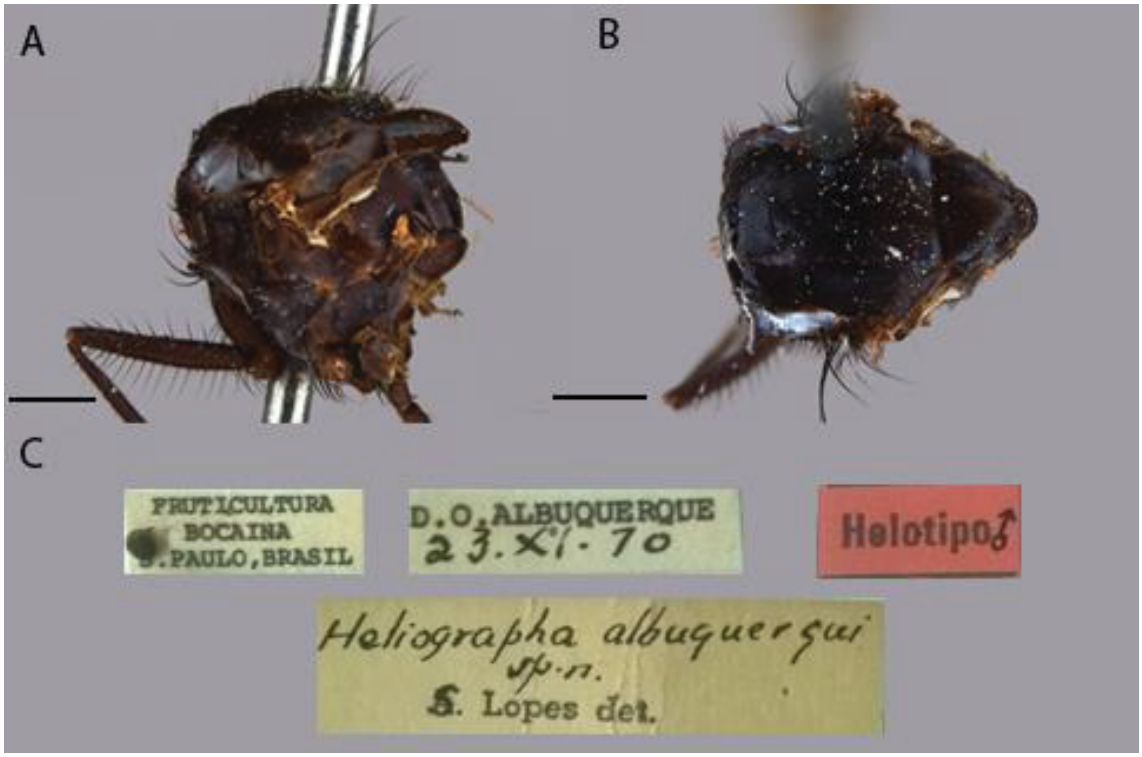

FIGURE 2. *Limnophora albuquerquei*. Holotype. Male: **A.** Thorax, lateral view. **B**. habitus, dorsal view. **C**. Labels. Scale bars: 1mm.

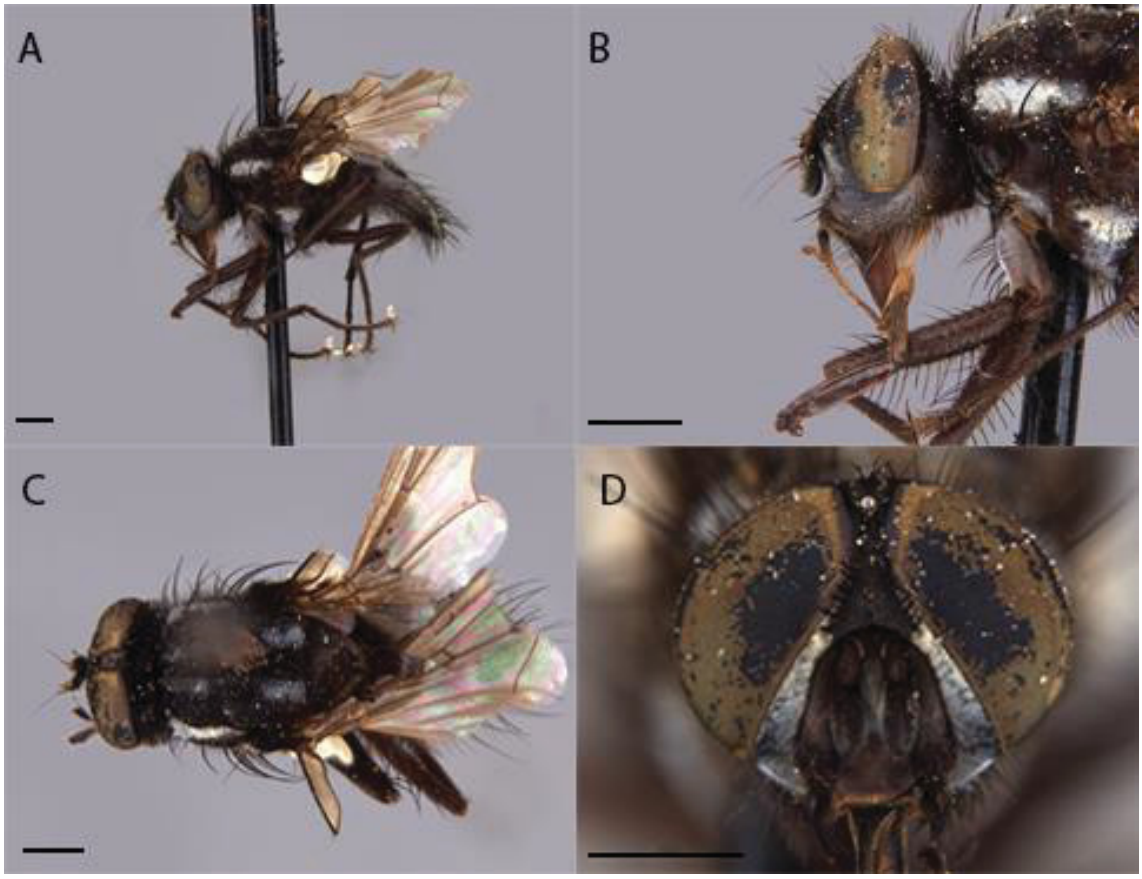

FIGURE 3. *Limnophora albuquerquei*. Nontype. Male: **A.** Habitus, lateral view. **B**. Head, lateral view. **C**. Thorax, dorsal view. **D.** Head, frontal view. Scale bars: 1mm

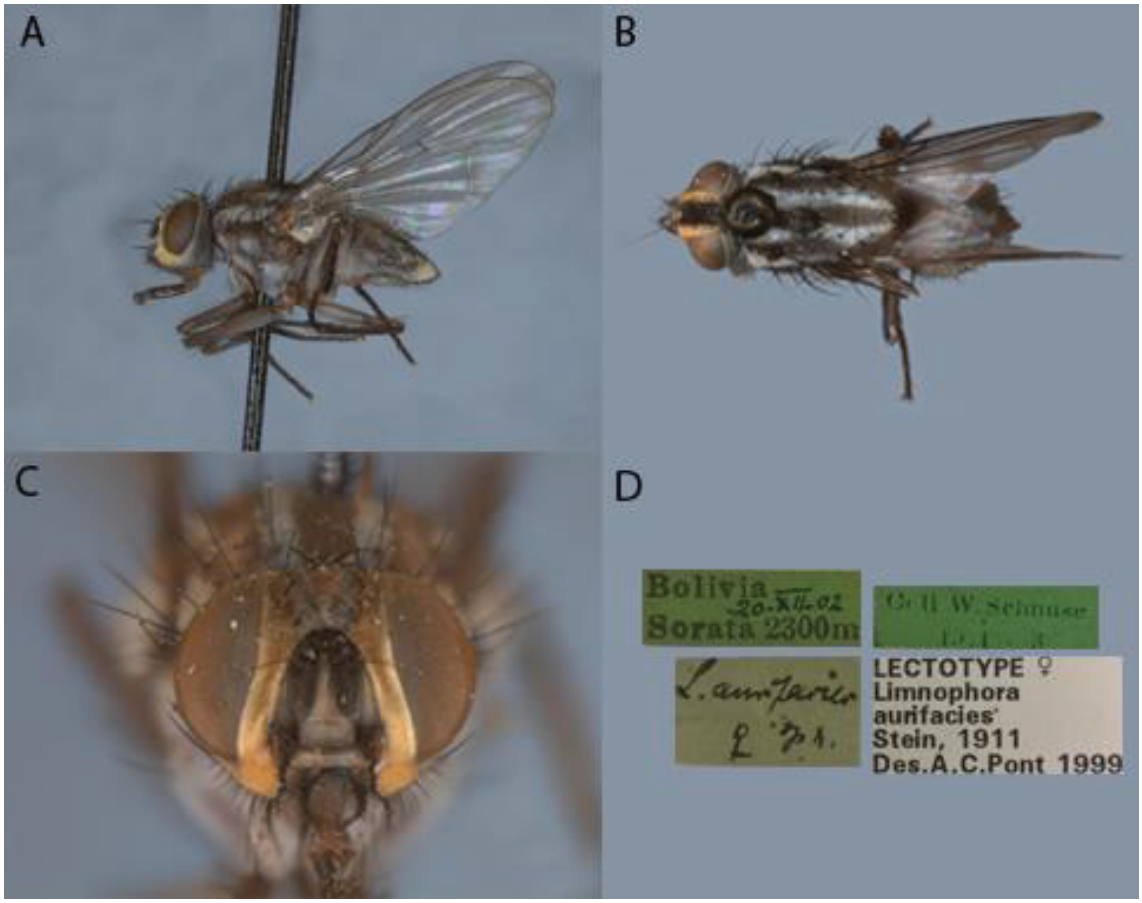

FIGURE 4. *Limnophora aurifacies*. Lectotype. Male: **A.** Habitus, lateral view. **B**. Thorax, dorsal view. **C**. Head, frontal view. **D.** Labels. Scale bars: (**A**, **B**) = 2mm. (**C**)= 500µm

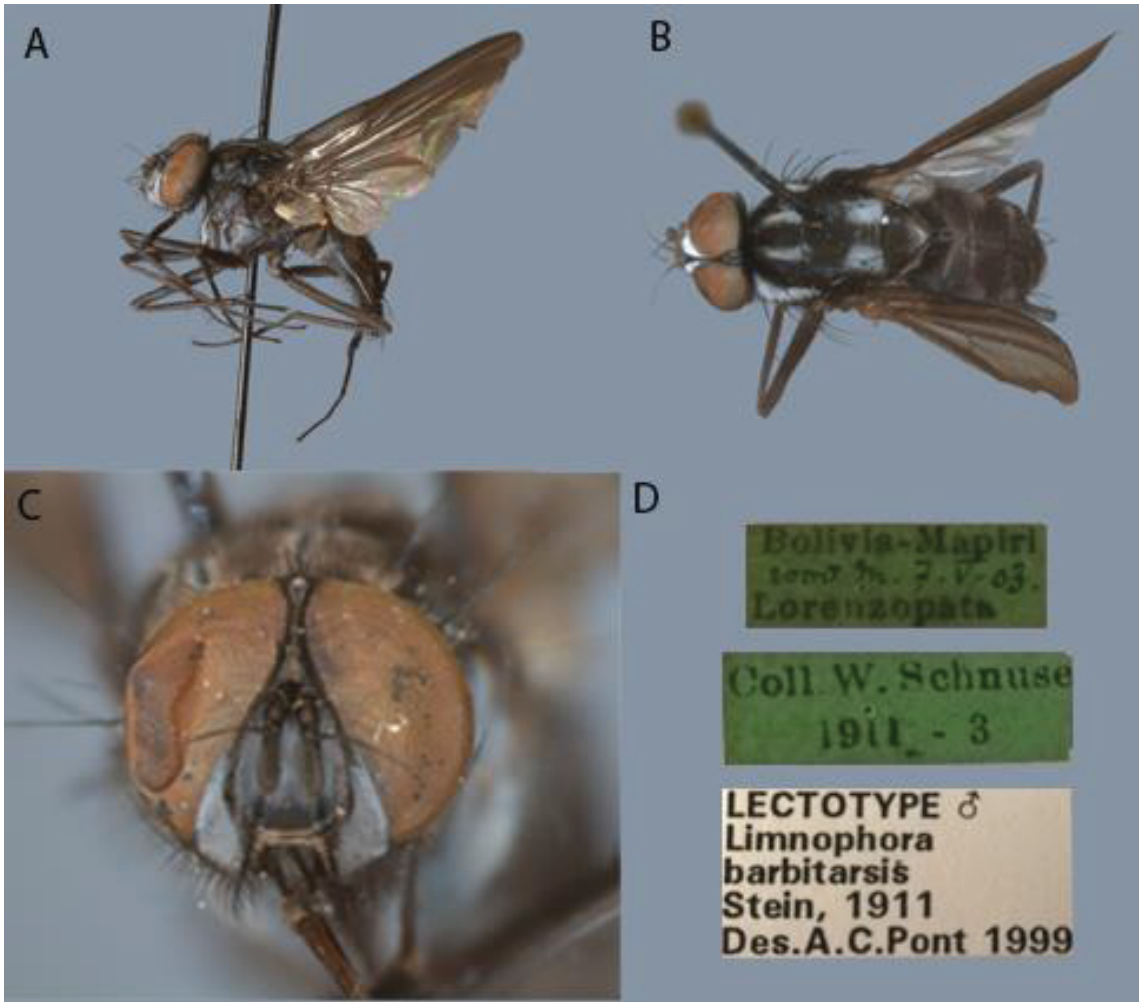

FIGURE 5. *Limnophora barbitarsis*. Lectotype. Male: **A.** Habitus, lateral view. **B**. Thorax, dorsal view. **C**. Head, frontal view. **D.** Labels. Scale bars: (**A**, **B**) = 2mm. (**C**)= 1mm

FIGURE 6. *Limnophora barbitarsis*. paralectotype. female: **A.** Habitus, lateral view. **B**. Thorax, dorsal view. **V**. Head, frontal view. scale bars: (**A**, B) = 2mm. (**C**)= 1mm

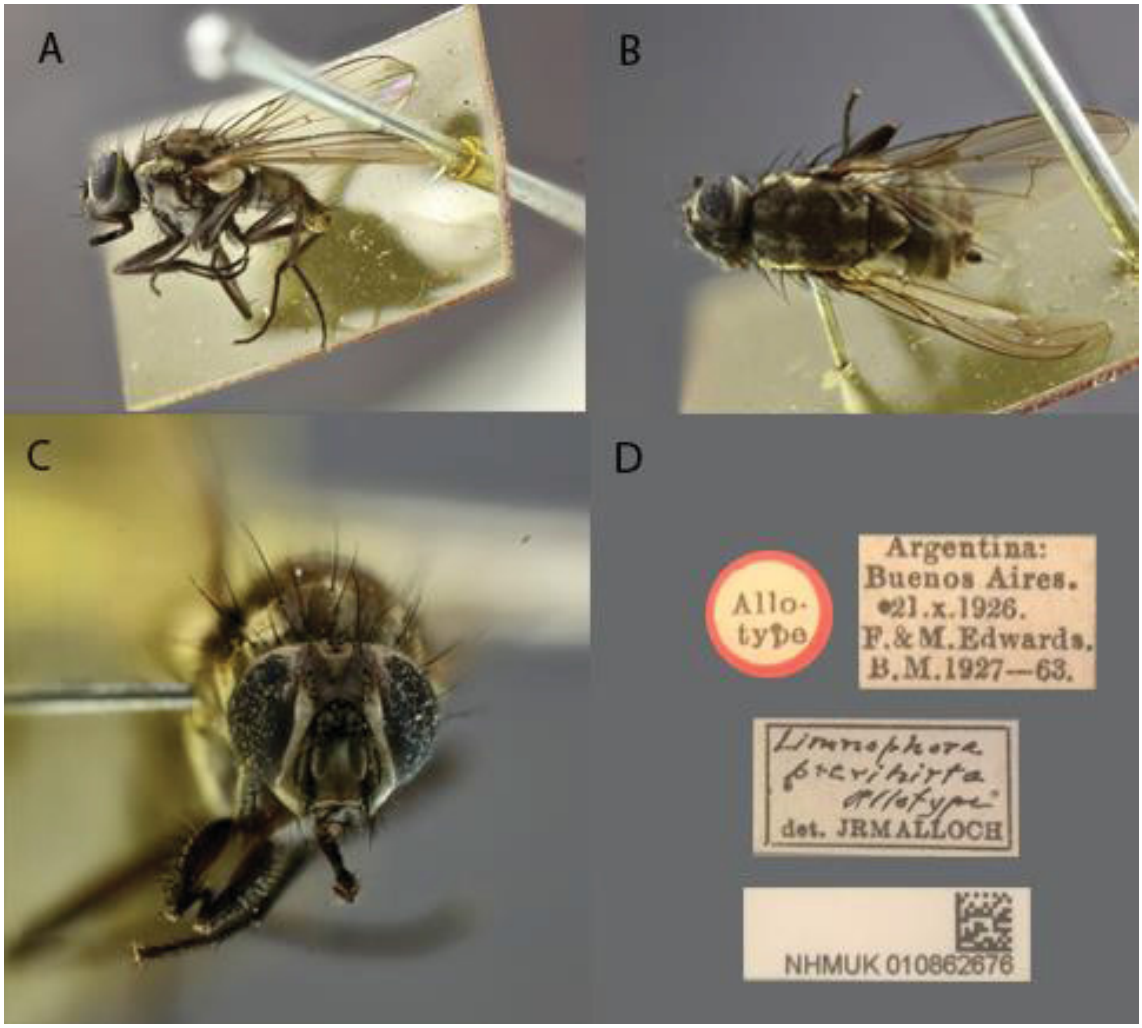

FIGURE 7. *Limnophora brevihirta*. Allotype. Female: **A**. Habitus, lateral view. **B**. Thorax, dorsal view. **C**. Head, frontal view. **D**. Labels

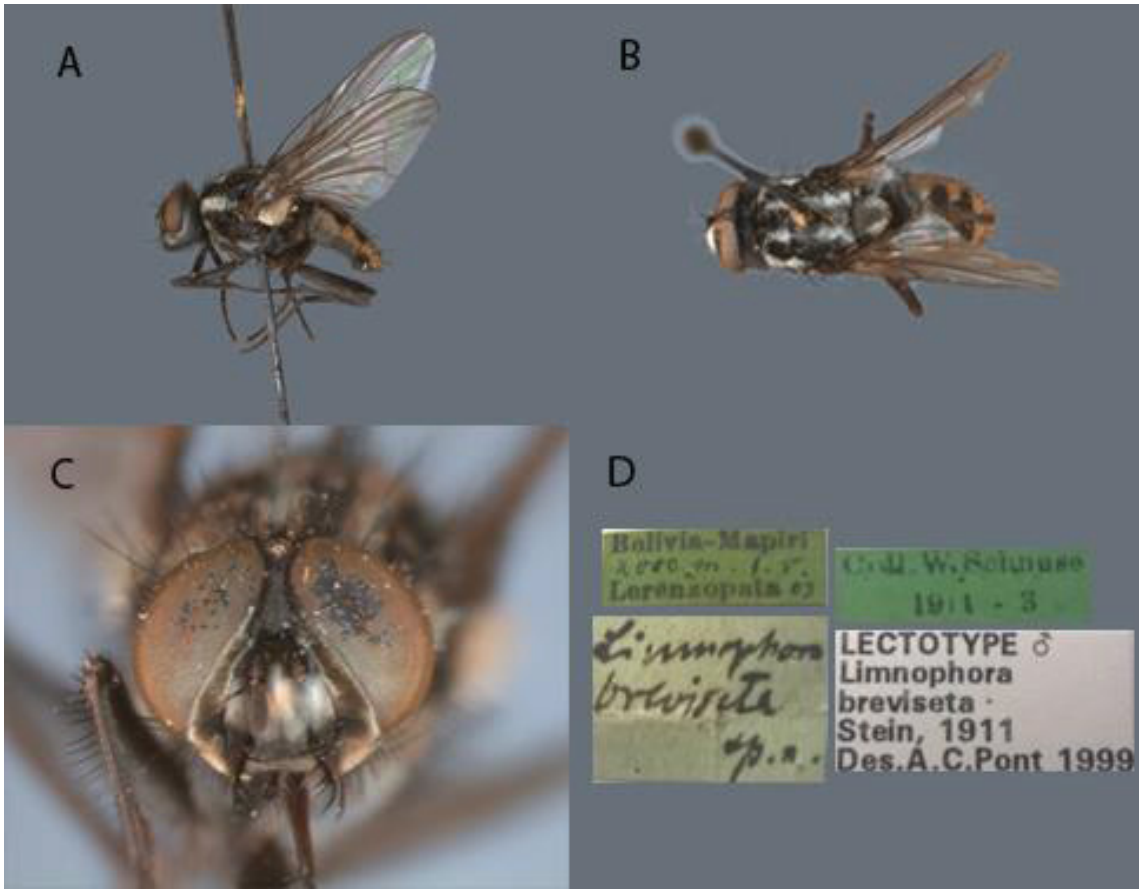

FIGURE 8. *Limnophora breviseta*. Lectotype. Male: **A.** Habitus, lateral view. **B**. Thorax, dorsal view. **C**. Head, frontal view. **D.** Labels

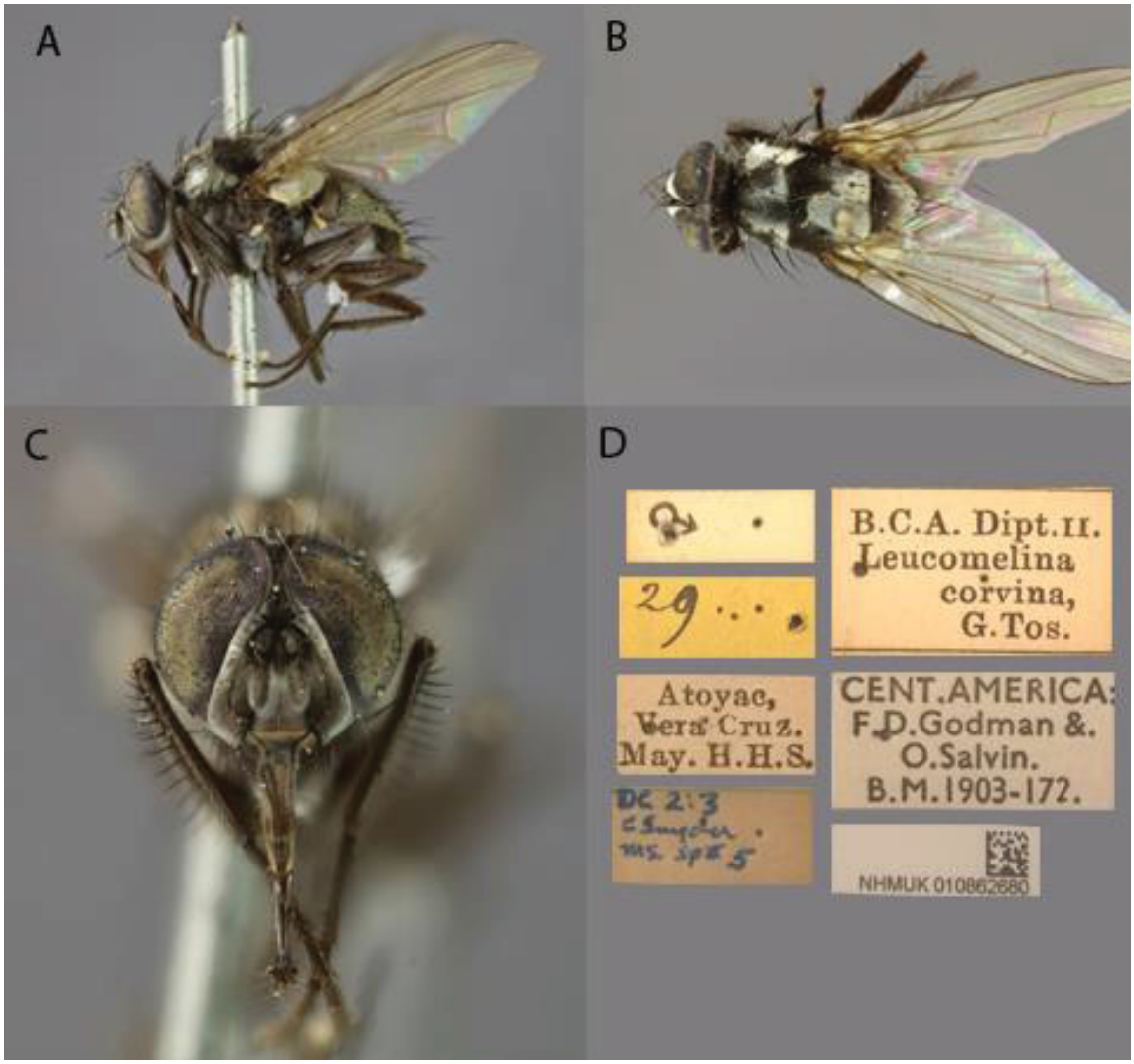

FIGURE 9. *Limnophora corvina*. Nontype. male: **A.** Habitus, lateral view. **B**. Thorax, dorsal view. **C**. Head, frontal view. **D.** Labels

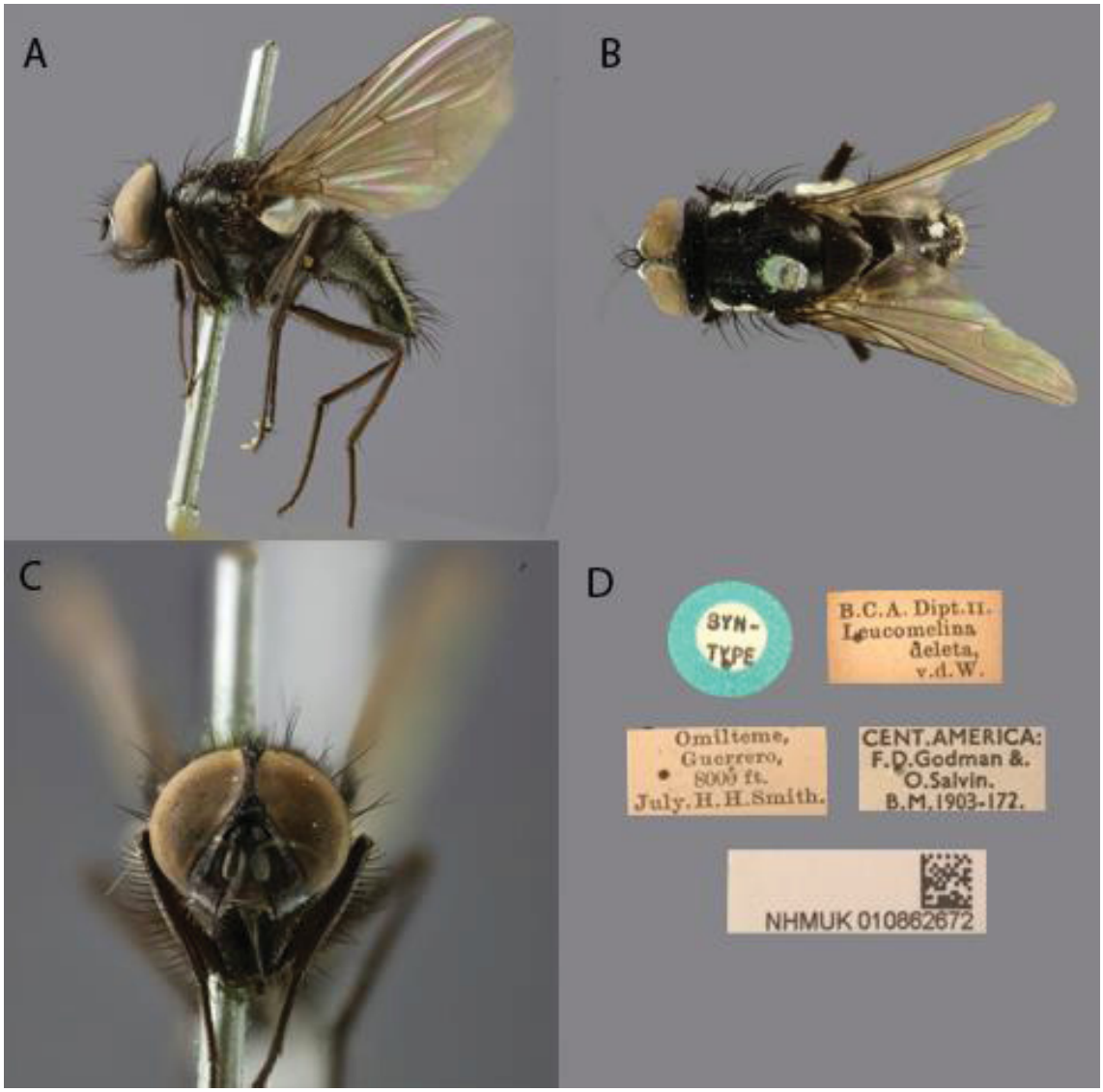

FIGURE 10. *Limnophora deleta*. Lectotype, here designated. Male: **A.** Habitus, lateral view. **B**. Thorax, dorsal view. **C**. Head, frontal view. **D.** Labels

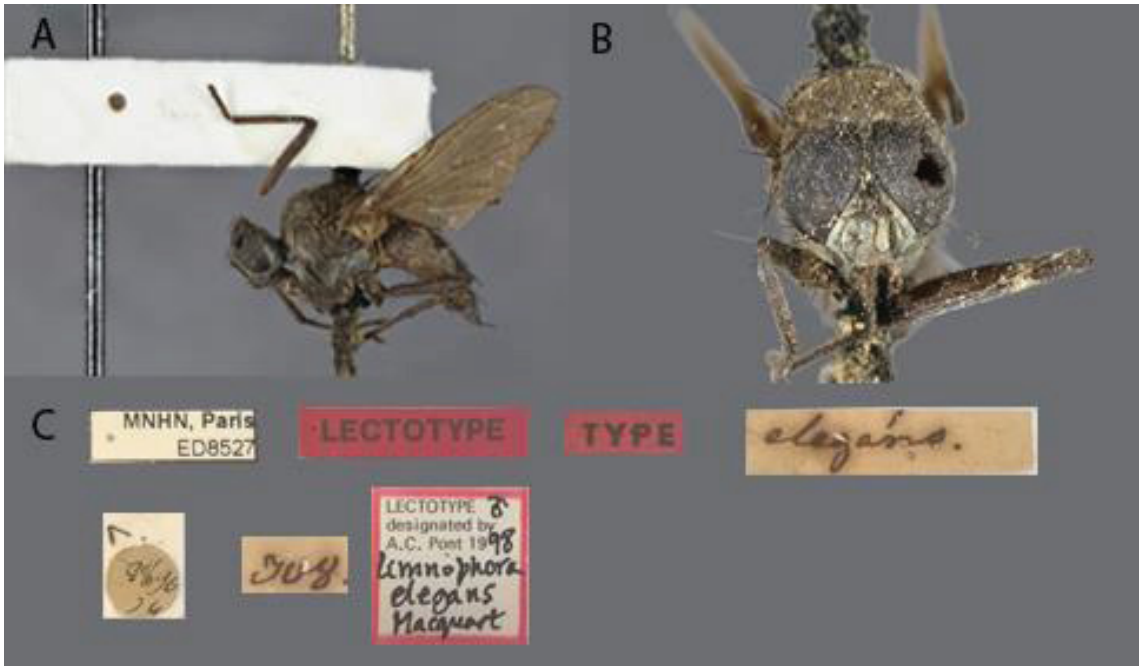

FIGURE 11. *Limnophora elegans*. Lectotype. Male: **A.** Habitus, lateral view. **B**. Head, frontal view. **C**. Labels

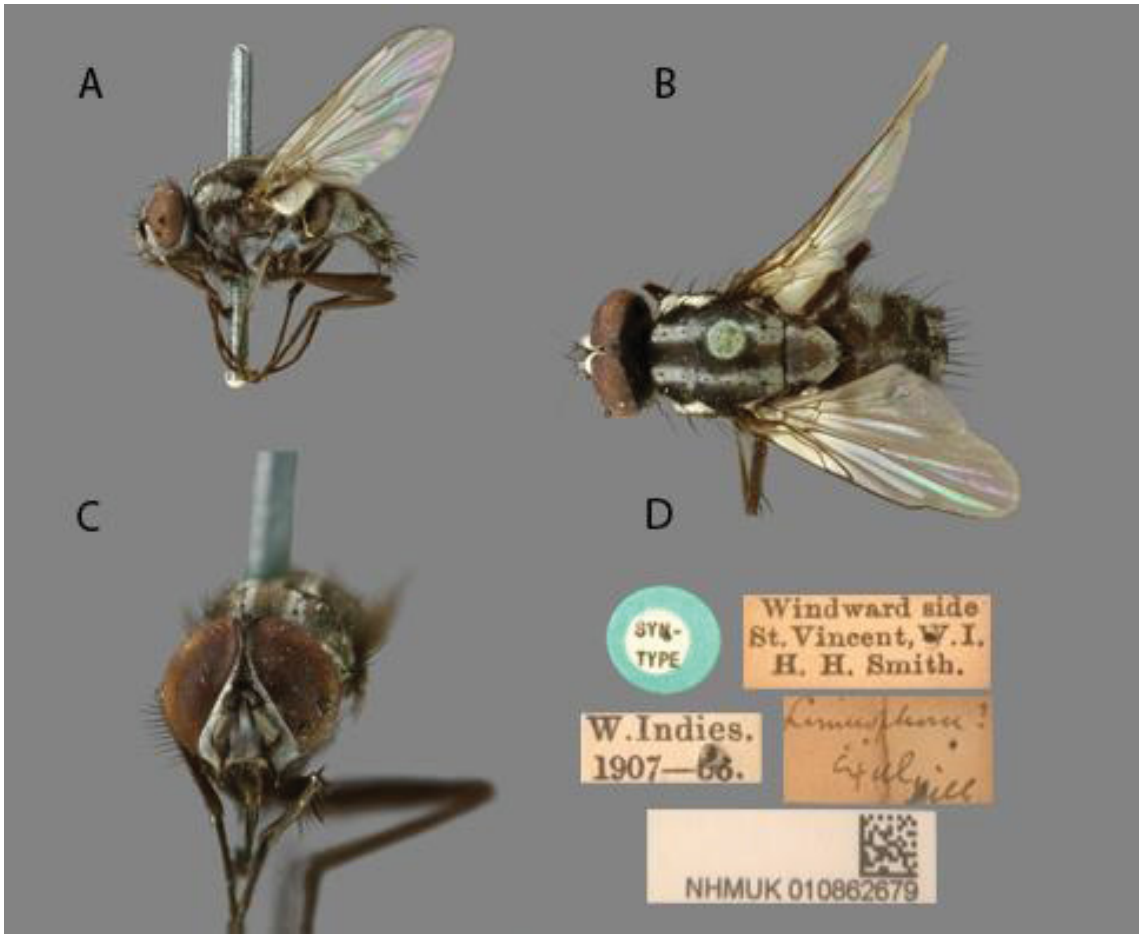

FIGURE 12. *Limnophora exul*. Lectotype, here designated. Male: **A.** Habitus, lateral view. **B**. Thorax, dorsal view. **C**. Head, frontal view. **D.** Labels

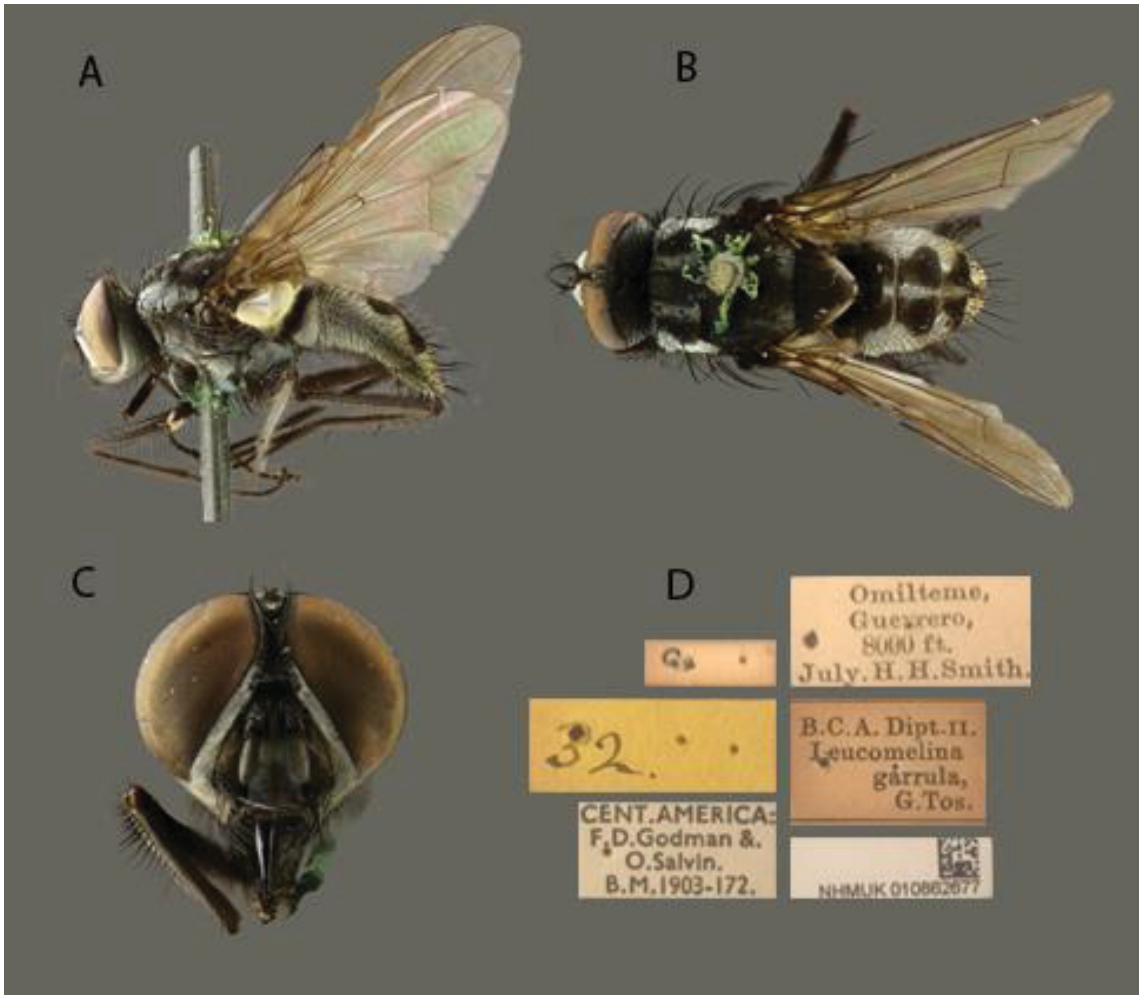

FIGURE 13. *Limnophora garrula*. Nontype. Male: **A.** Habitus, lateral view. **B**. Thorax, dorsal view. **C**. Head, frontal view. **D.** Labels

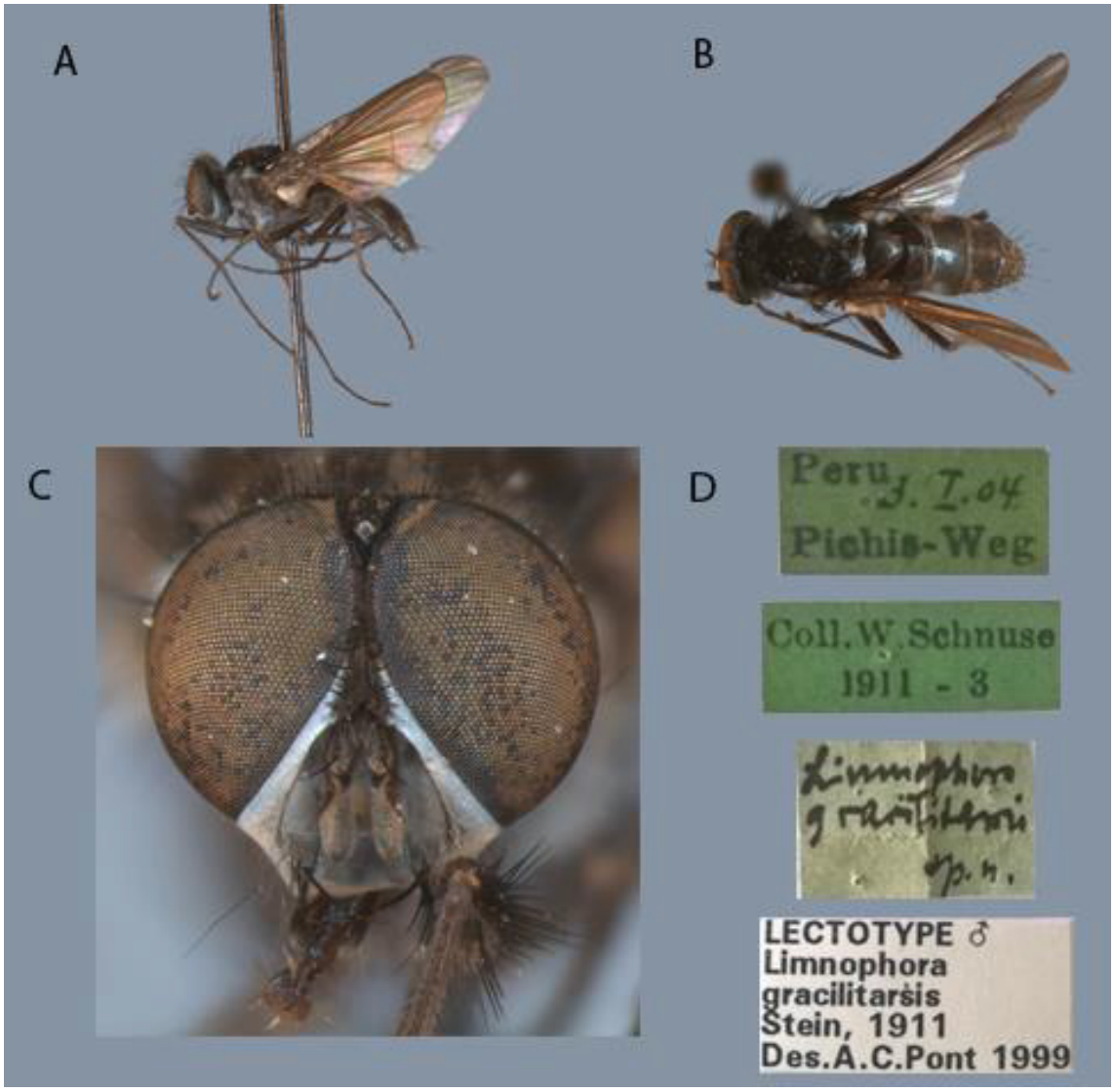

FIGURE 14. *Limnophora gracilitarsis*. Lectotype. Male: **A.** Habitus, lateral view. **B**. Thorax, dorsal view. **C**. Head, frontal view. **D.** Labels

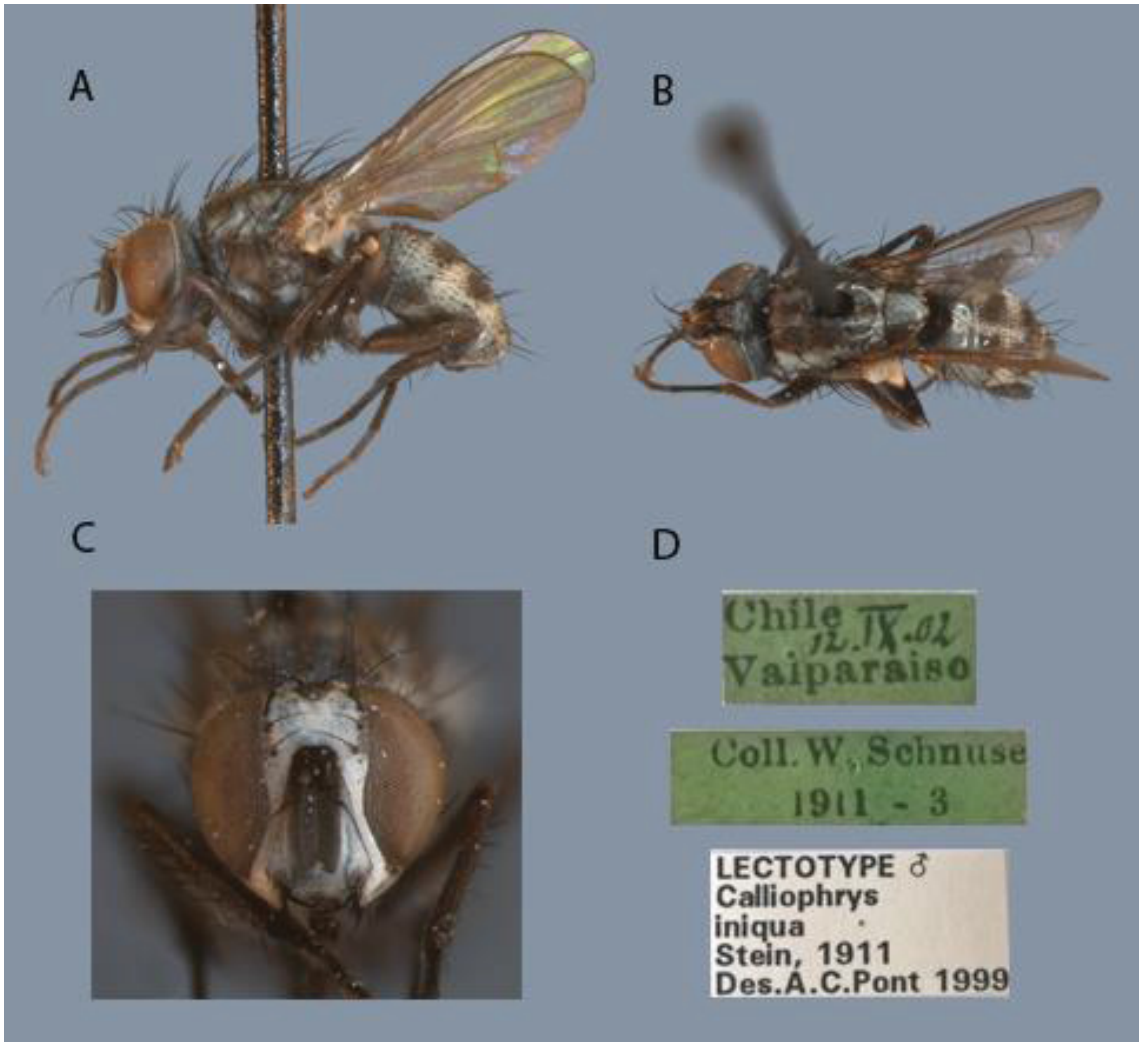

FIGURE 15. *Limnophora iniqua*. Lectotype. Male: **A.** Habitus, lateral view. **B**. Thorax, dorsal view. **C**. Head, frontal view. **D.** Labels

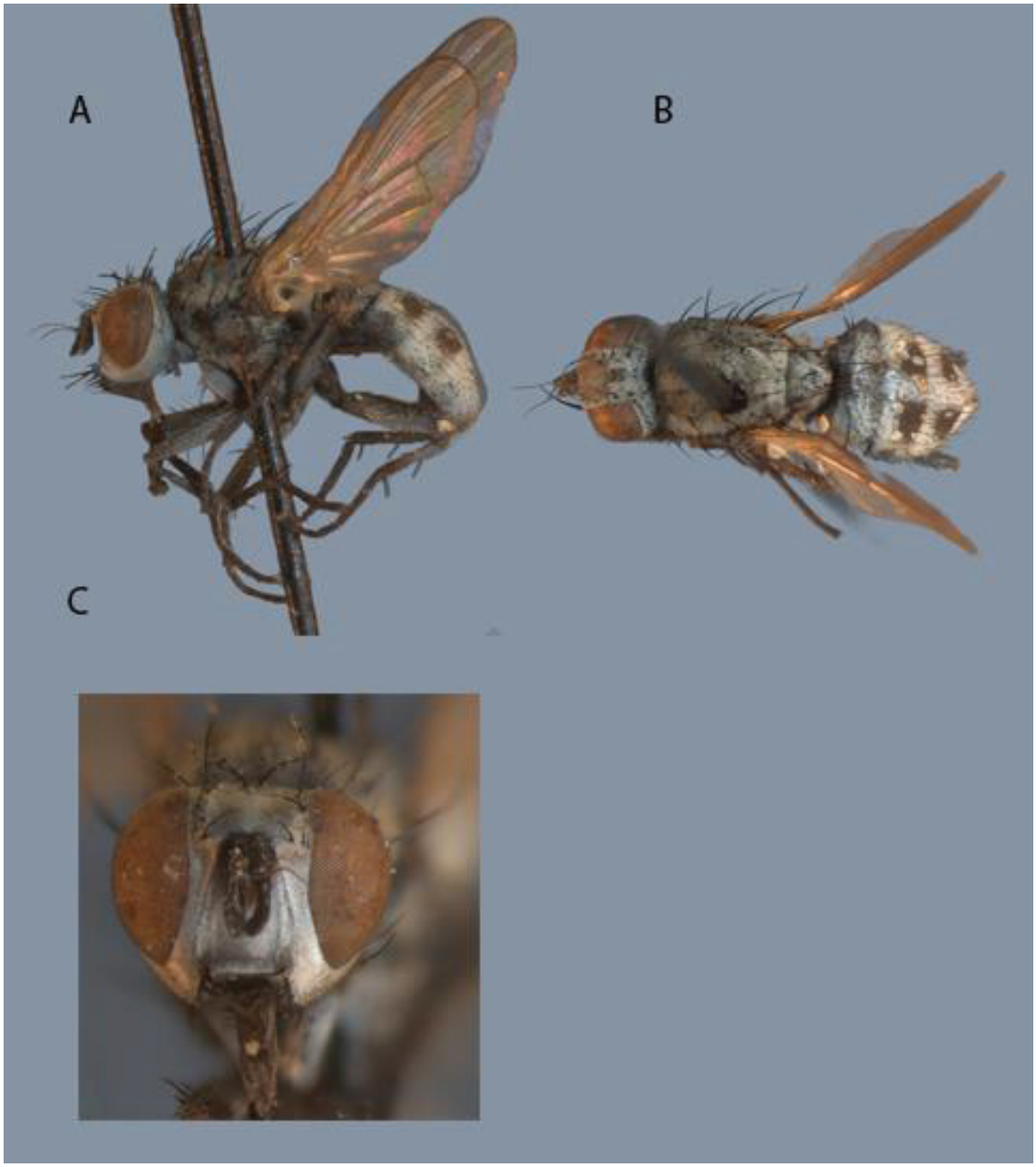

FIGURE 16. *Limnophora iniqua*. Paralectotype. Female: **A.** Habitus, lateral view. **B**. Thorax, dorsal view. **C**. Head, frontal view

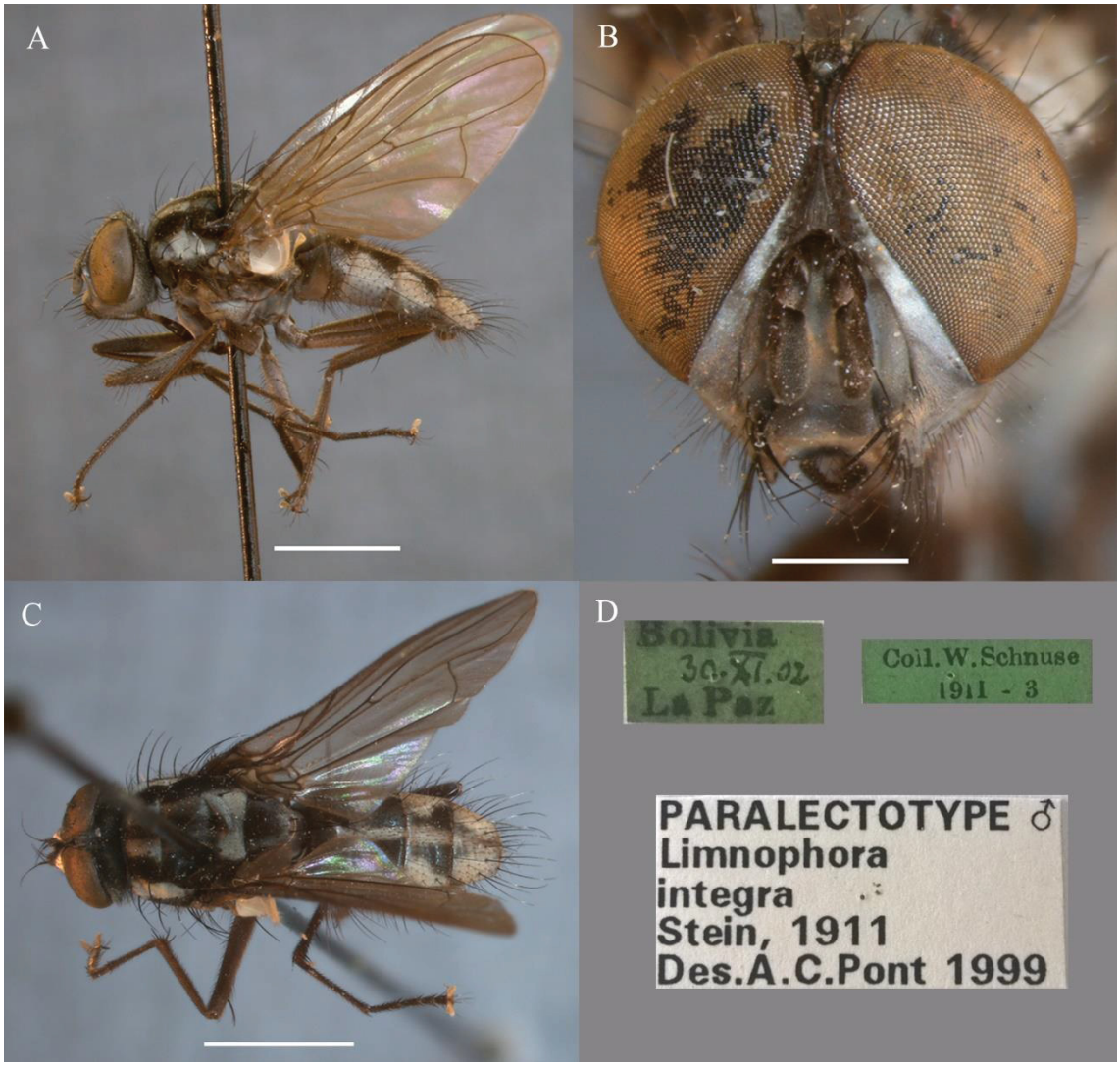

FIGURE 17. *Limnophora integra*. Lectotype. Male: **A.** Habitus, lateral view. **B**. Thorax, dorsal view. **C**. Head, frontal view. **D.** Labels

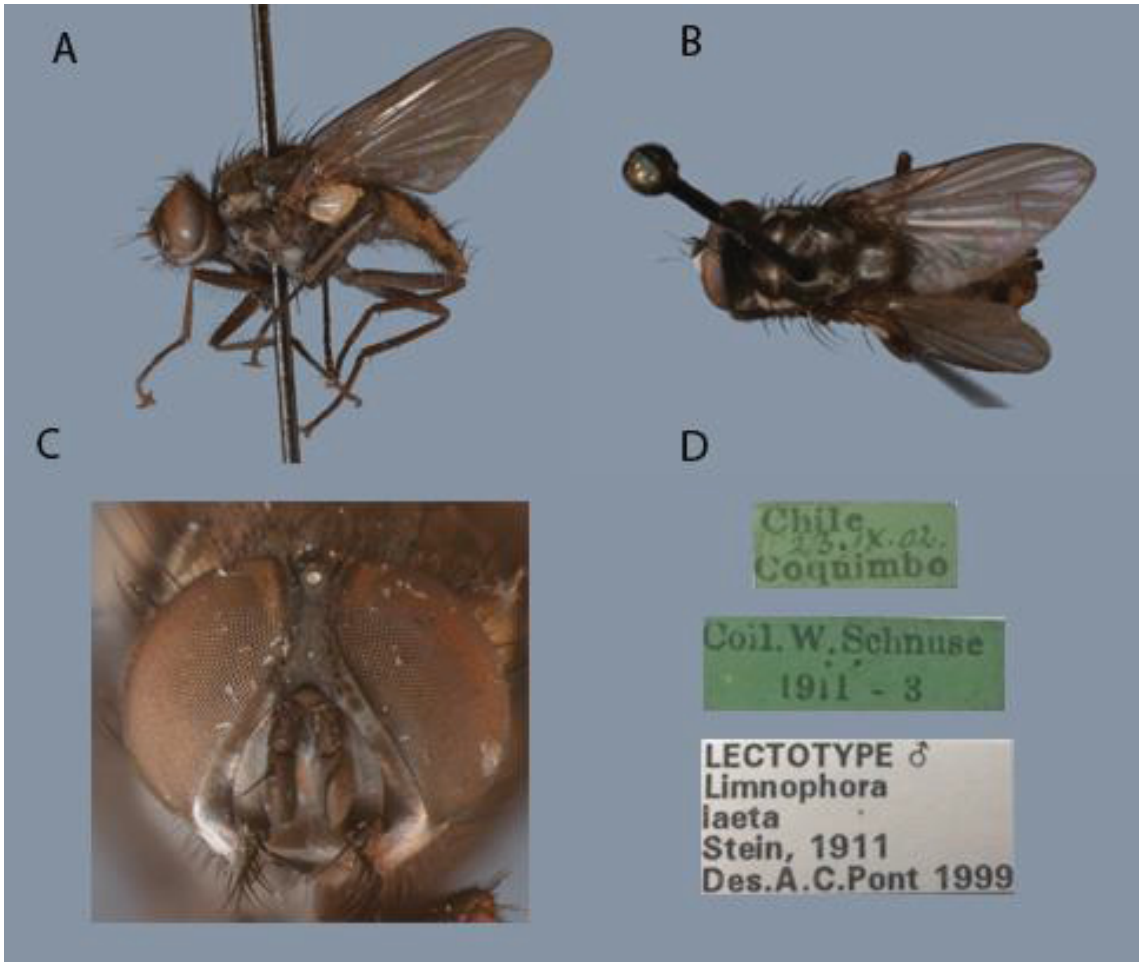

FIGURE 18. *Limnophora laeta*. Lectotype. Male: **A.** Habitus, lateral view. **B**. Thorax, dorsal view. **C**. Head, frontal view. **D.** Labels

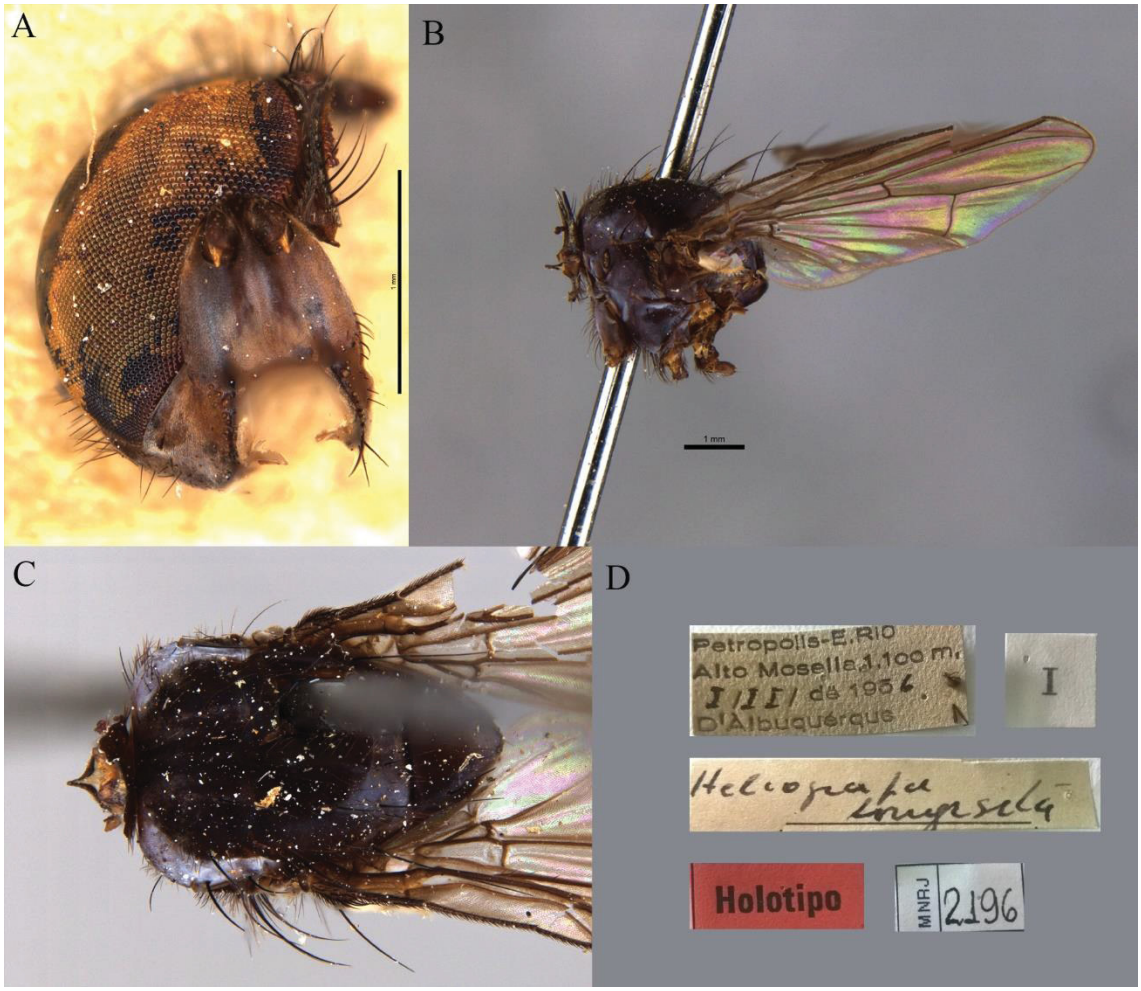

FIGURE 19. *Limnophora lopesae*. Holotype. Female: **A.** Head, frontal view. **B**. Habitus, lateral view. **C**. Thorax, dorsal view. **D.** Labels

FIGURE 20. *Limnophora marginipennis*. Syntype. Female: **A.** Habitus, lateral view. **B**. Head, frontal view. **C**. Thorax, dorsal view. **D.** Labels. Scale bars (**A**, **C**) = 2mm, (**B**) = 1mm

FIGURE 21. *Limnophora minuscula*. Lectotype, here designated. Male: **A.** Habitus, lateral view. **B**. Head, frontal view. **C**. Thorax, dorsal view. **D.** Labels

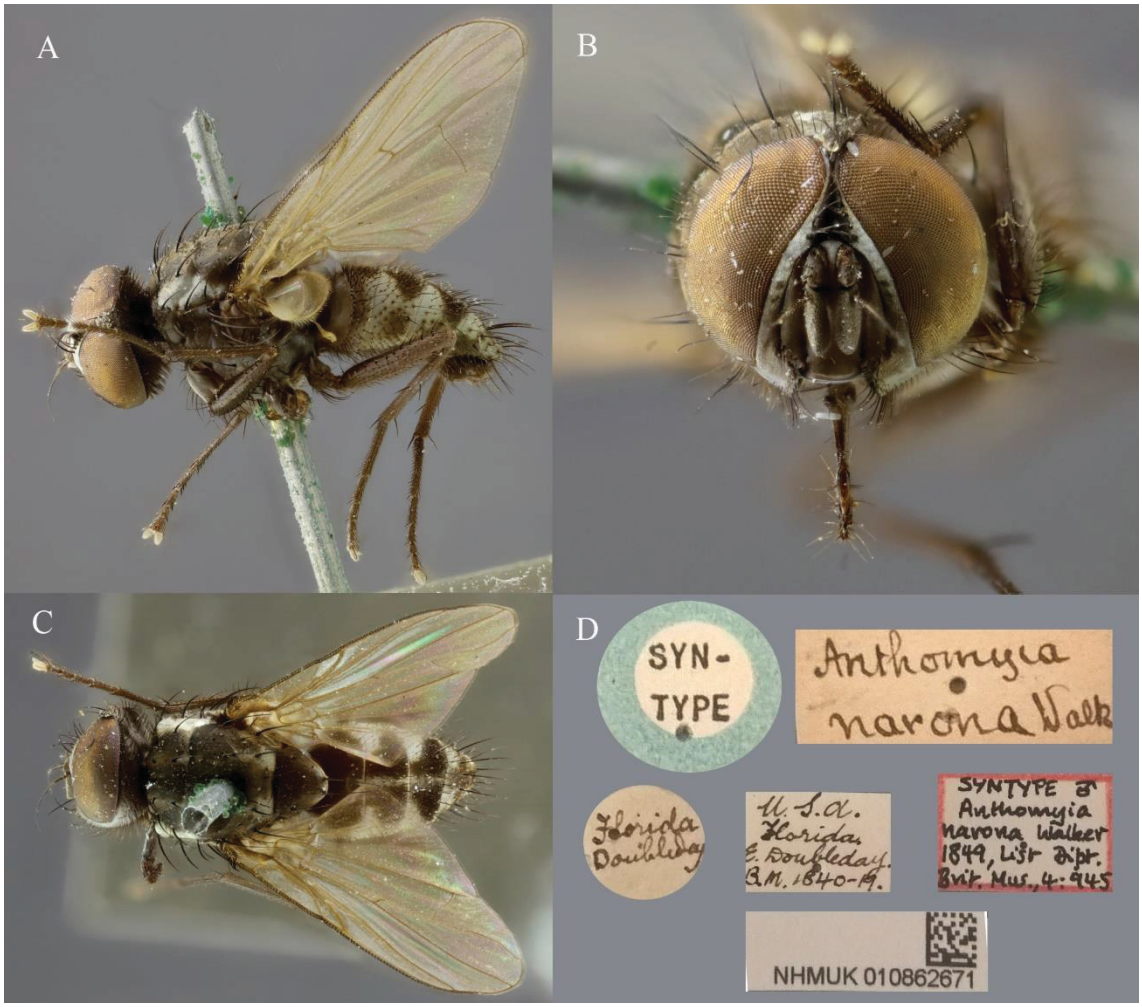

FIGURE 22. *Limnophora narona*. Lectotype, here designated. Male: **A.** Habitus, lateral view. **B**. Head, frontal view. **C**. Thorax, dorsal view. **D.** Labels

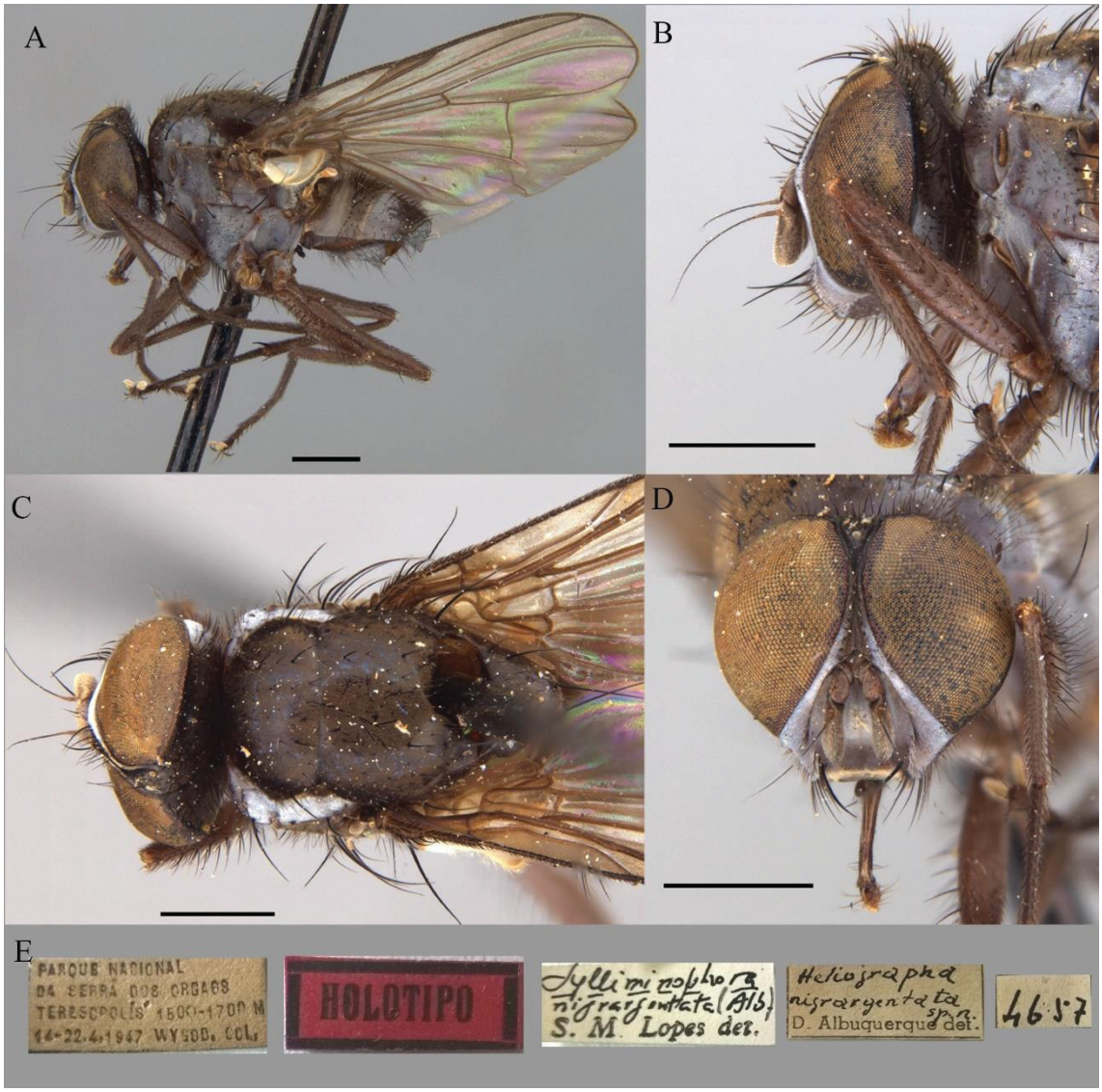

FIGURE 23. *Limnophora nigrargentata*. Holotype. Male: **A.** Habitus, lateral view. **B**. Head, lateral view. **C**. Thorax, dorsal view. **D.** Head, frontal view. **E.** Labels. Scale bars: 1mm

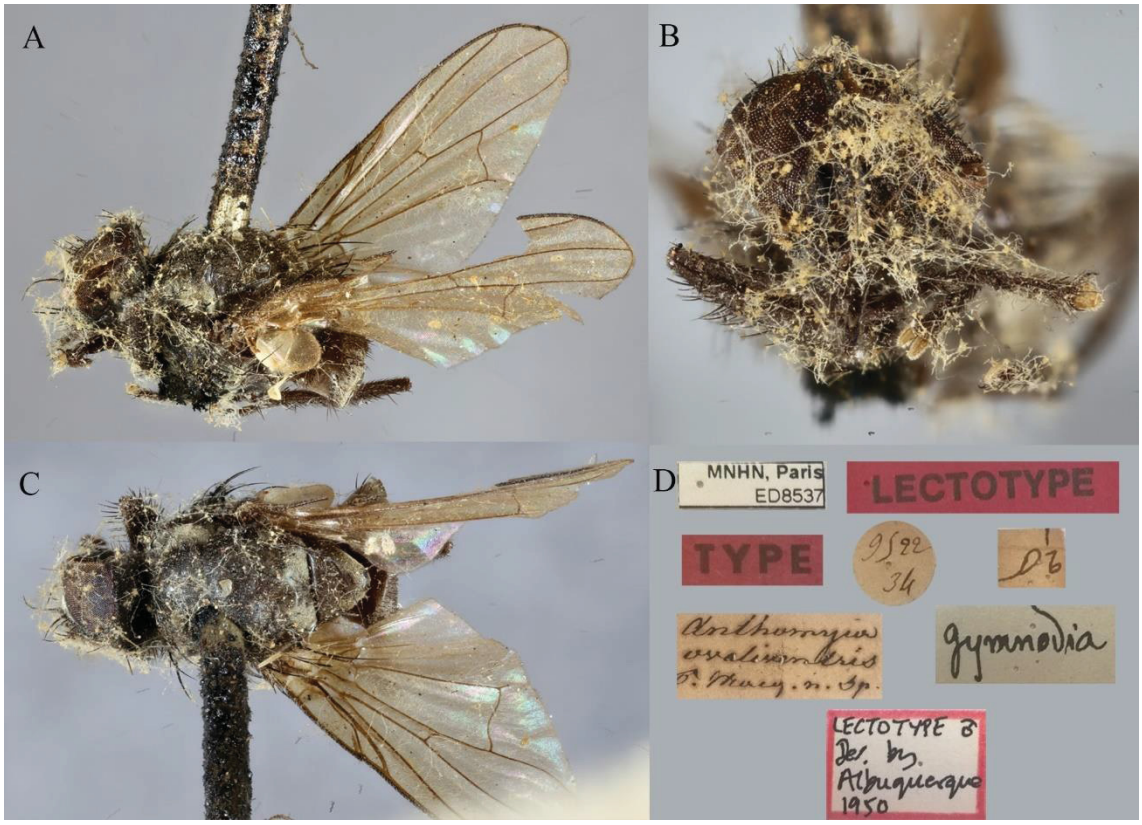

FIGURE 24. *Limnophora ovativentris*. Lectotype. Male: **A.** Habitus, lateral view. **B**. Head, frontal view. **C**. Thorax, dorsal view. **D.** Labels

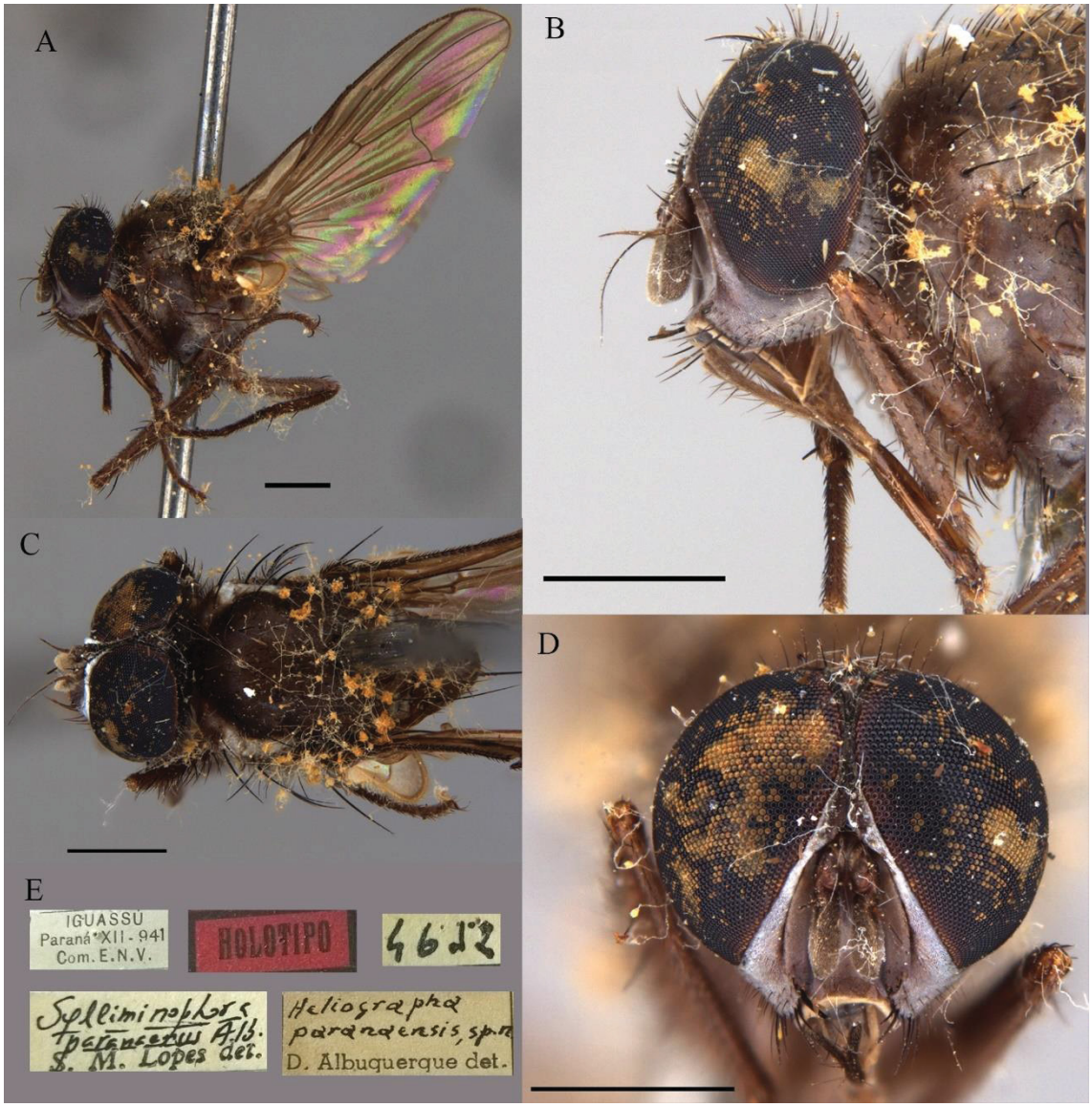

FIGURE 25. *Limnophora paranaensis*. Holotype. Male: **A.** Habitus, lateral view. **B**. Head, lateral view. **C**. Thorax, dorsal view. **D.** Head, frontal view. **E.** Labels. Scale bars: 1mm

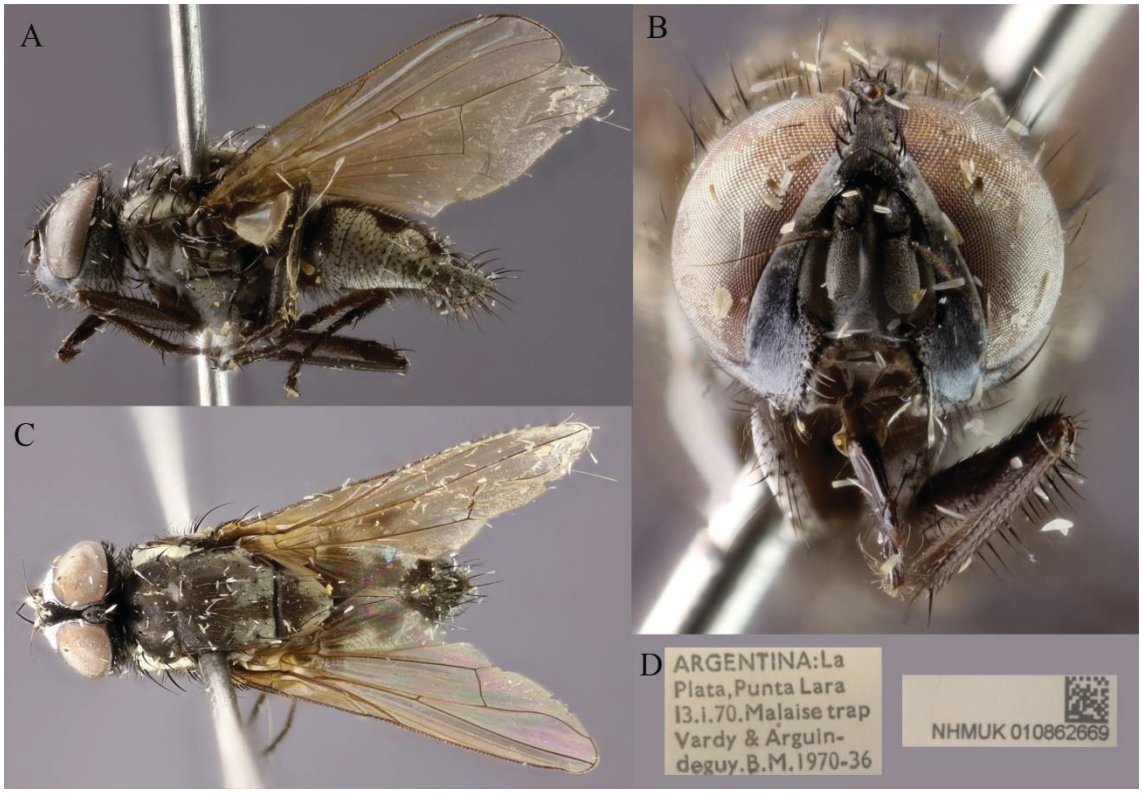

FIGURE 26. *Limnophora patagonica*. Nontype. Male: **A.** Habitus, lateral view. **B**. Head, frontal view. **C**. Thorax, dorsal view. **D.** Labels

FIGURE 27. *Limnophora patagonica*. Allotype. Female: **A.** Habitus, lateral view. **B**. Head, frontal view. **C**. Thorax, dorsal view. **D.** Labels

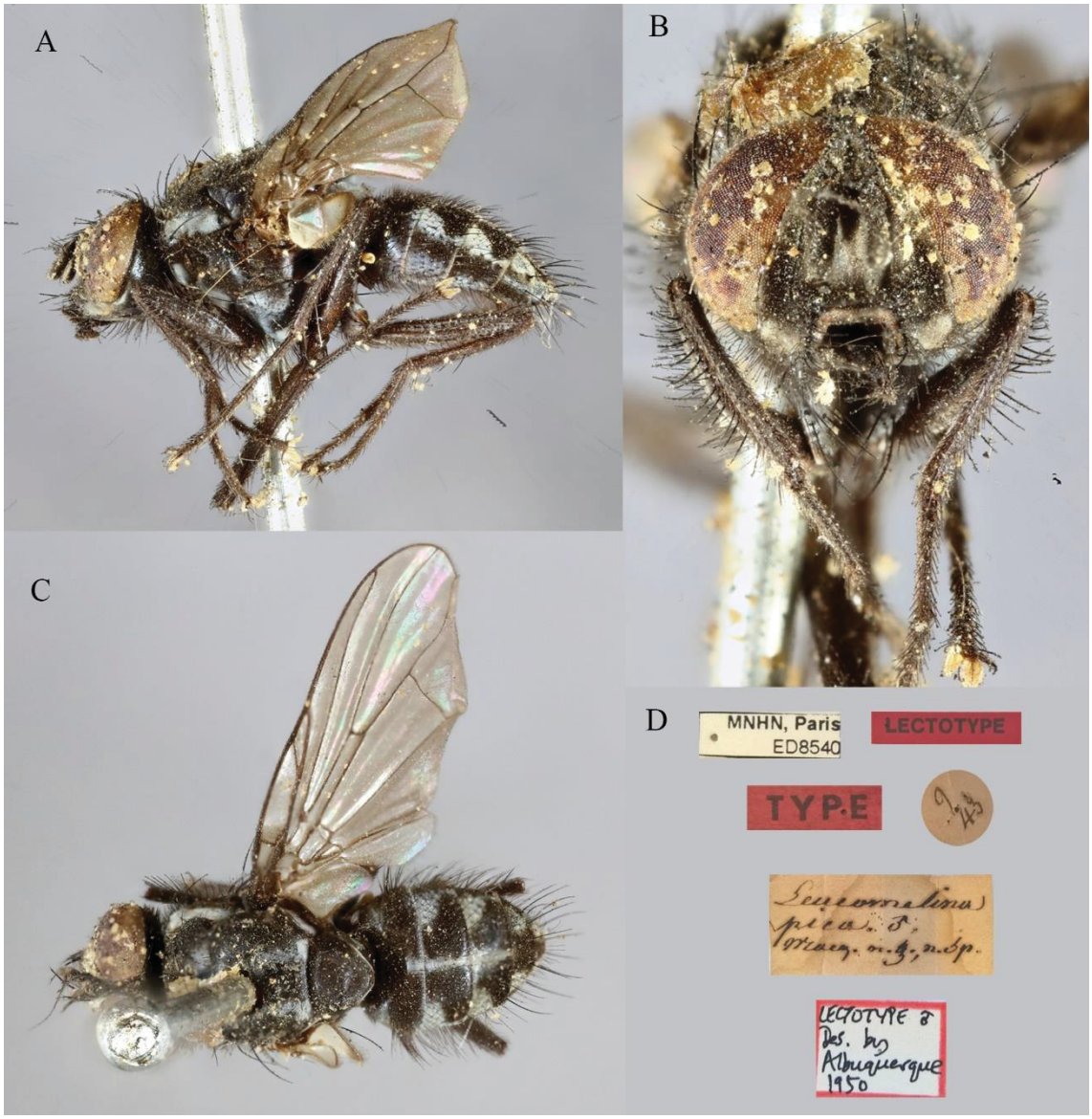

FIGURE 28. *Limnophora pica*. Lectotype. Male: **A.** Habitus, lateral view. **B**. Head, frontal view. **C**. Thorax, dorsal view. **D.** Labels

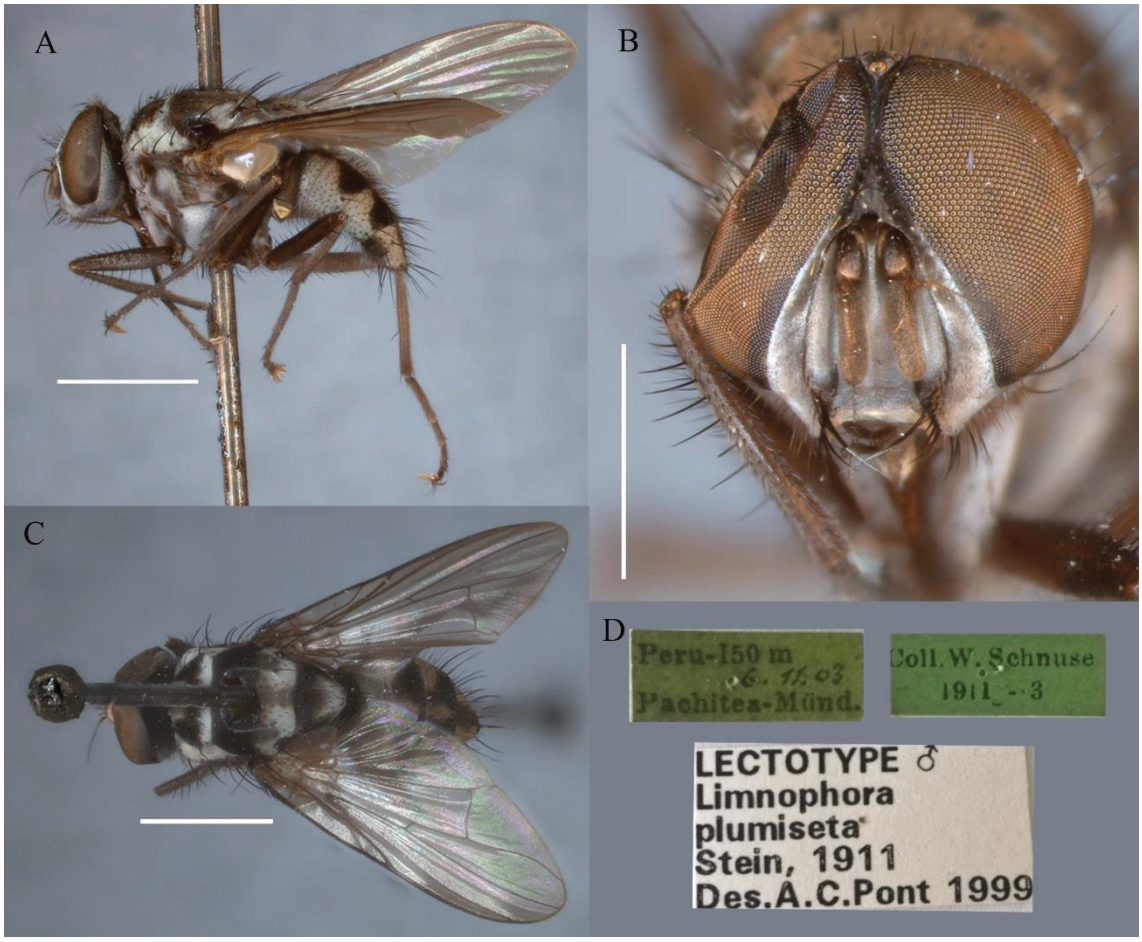

FIGURE 29. *Limnophora plumiseta*. Lectotype. Male: **A.** Habitus, lateral view. **B**. Head, frontal view. **C**. Thorax, dorsal view. **D.** Labels. Scale bars (**A**, **C**) = 2mm, (**B**) 1mm

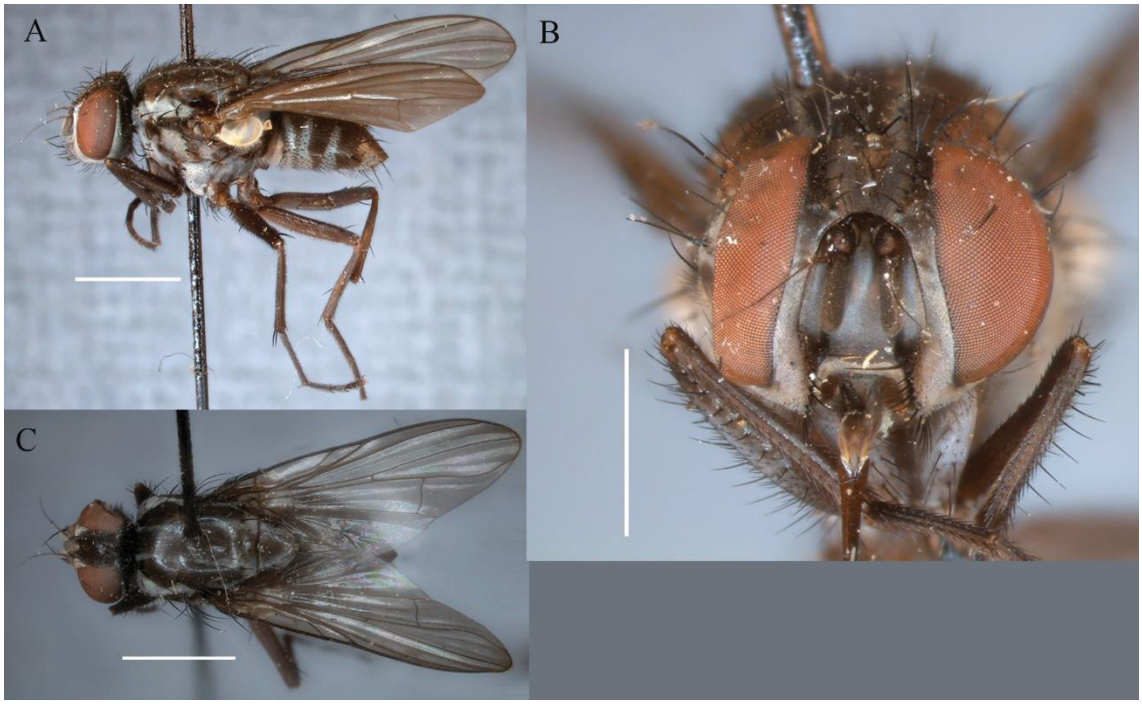

FIGURE 30. *Limnophora piliseta*. Nontype. Female: **A.** Habitus, lateral view. **B**. Head, frontal view. **C**. Thorax, dorsal view. Scale bars (**A**, **C**) = 2 mm, (**B**) 1mm

FIGURE 31. *Limnophora pura*. Lectotype. Male: **A.** Habitus, lateral view. **B**. Head, frontal view. **C**. Thorax, dorsal view. **D.** Labels. Scale bars (**A**, **C**) = 2mm, (**B**) 1mm

FIGURE 32. *Limnophora saeva*. Lectotype. Male: **A.** Habitus, lateral view. **B**. Head, frontal view. **C**. Thorax, dorsal view. **D.** Labels. Scale bars (**A**, **C**) = 1mm, (**B**) 0,5mm

FIGURE 33. *Limnophora vicaria*. Holotype. Male: **A.** Habitus, lateral view. **B**. Head, frontal view. **C**. Thorax, dorsal view. **D.** Labels

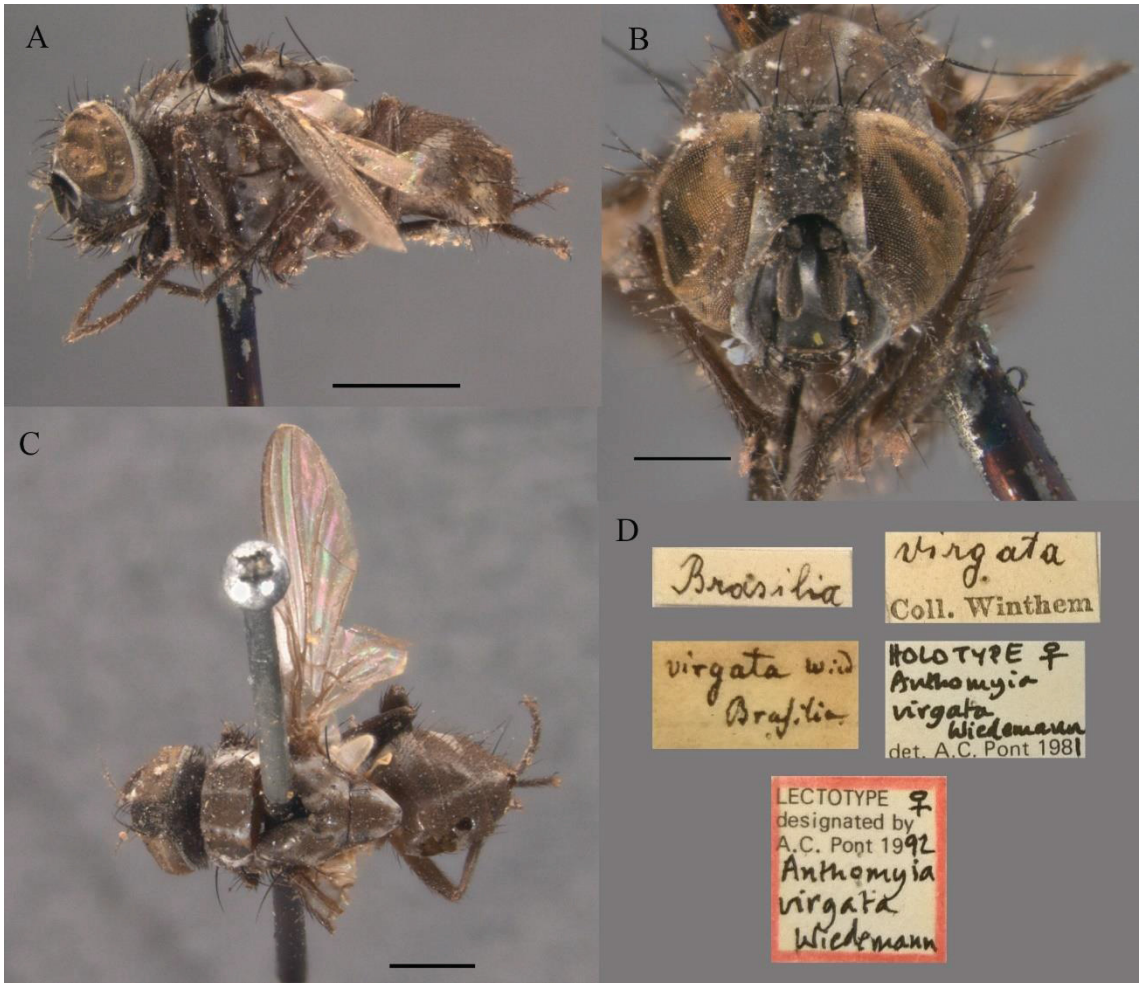

FIGURE 34. *Limnophora virgata*. Lectotype. Female: **A.** Habitus, lateral view. **B**. Head, frontal view. **C**. Thorax, dorsal view. **D.** Labels. Scale bars (**A**, **C**) = 1mm, (**B**) 0,5mm

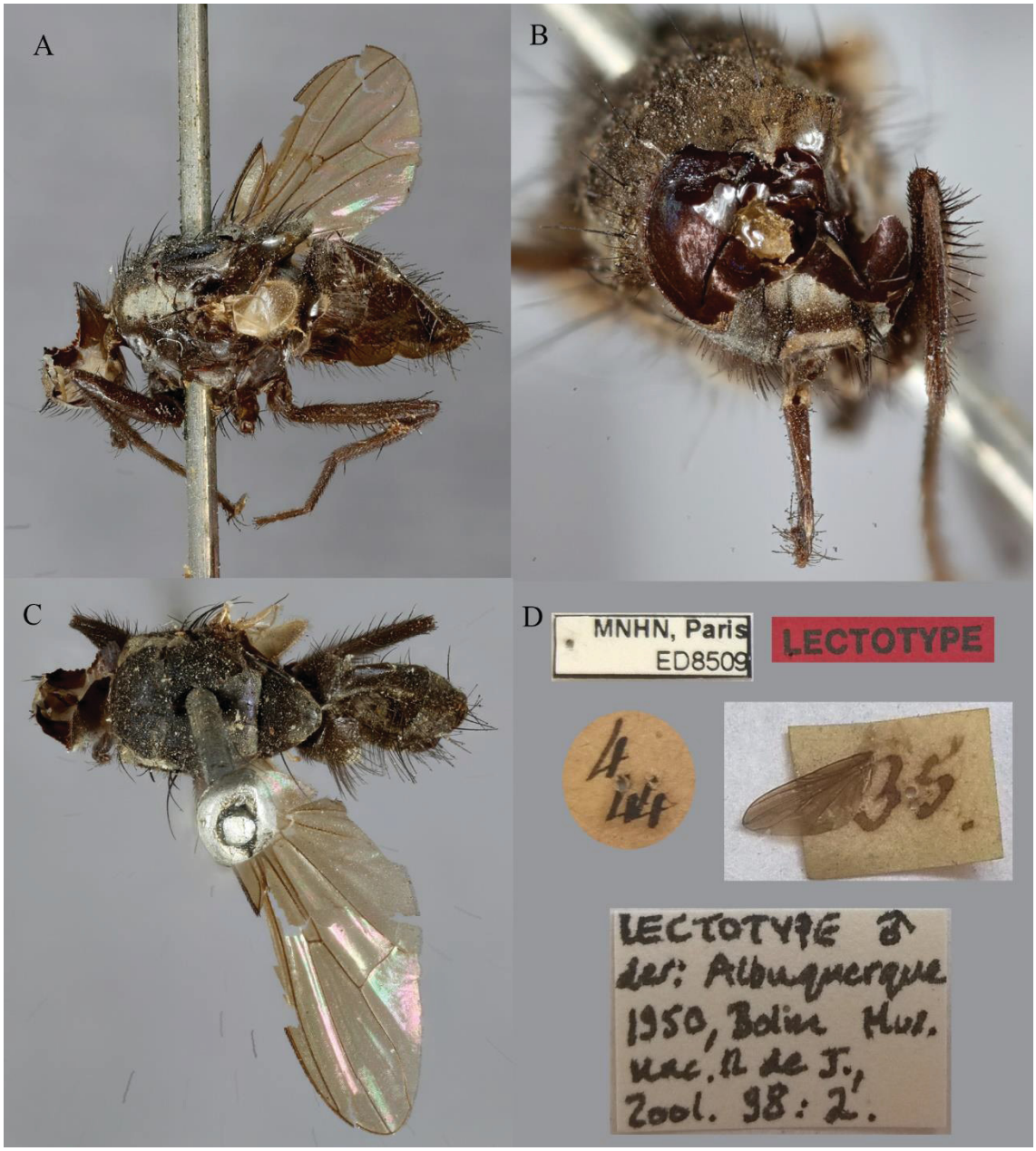

FIGURE 35. *Limnophora vittatum*. Lectotype. Male: **A.** Habitus, lateral view. **B**. Head, frontal view. **C**. Thorax, dorsal view. **D.** Labels

FIGURE 36. *Limnophora vittatum*. Paralectotype. Female: **A.** Habitus, lateral view. **B**. Head, frontal view. **C**. Thorax, dorsal view. **D.** Labels

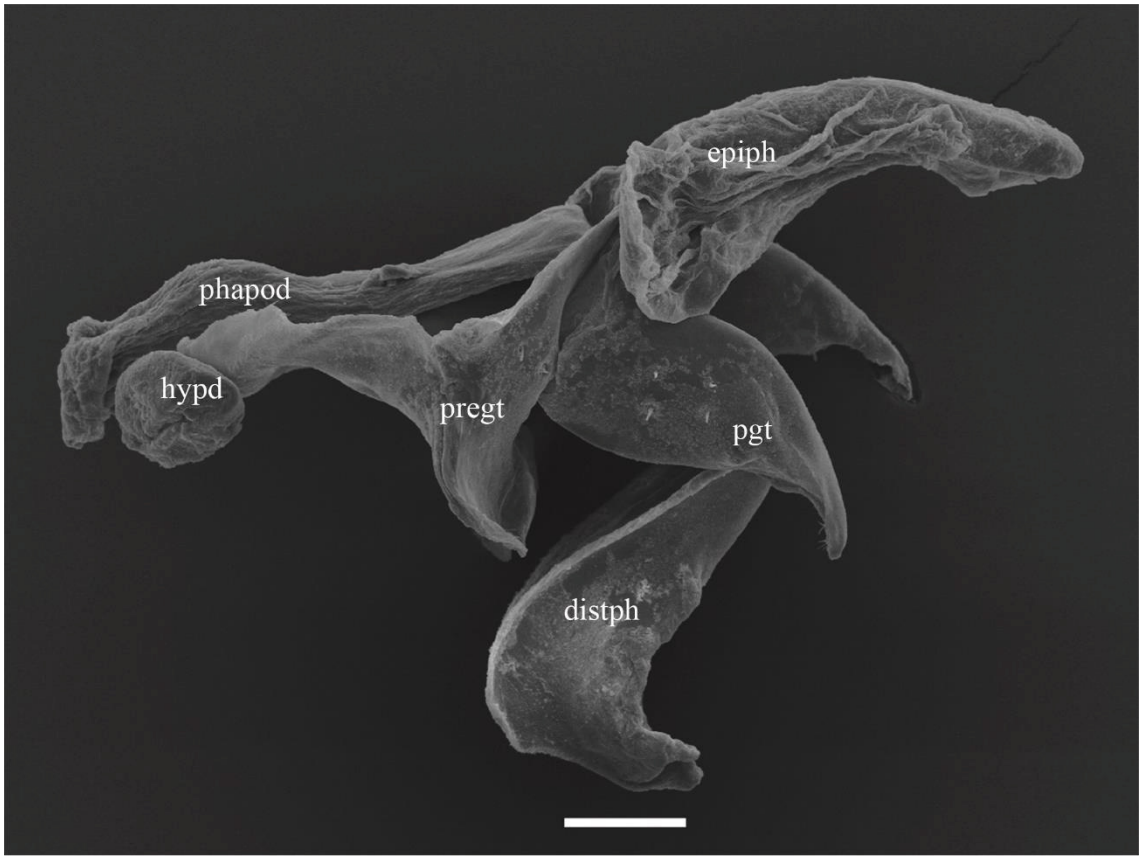

Figure 37. *Limnophora paranaensis*. Male terminalia, under a scanning electronic microscope (sem). Scale bar 50 μm. Abbreviations: hypd – hypandrium, phapod – phallapodeme, distph – distiphallus, pgt – postgonite.

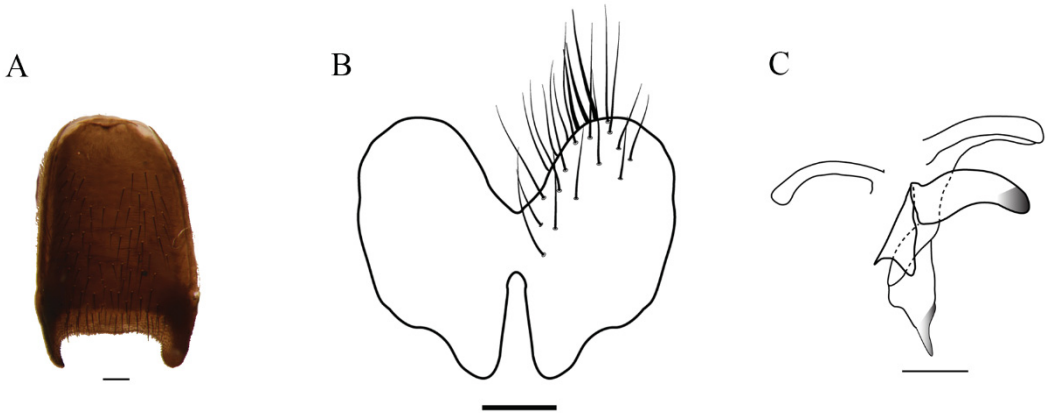

Figure 38. *Limnophora* **sp**. **nov**. **1**. Male: **A.** Sternite 5. **B.** Cercus. **C.** Phallic complex, lateral view. Scale bars: 1mm

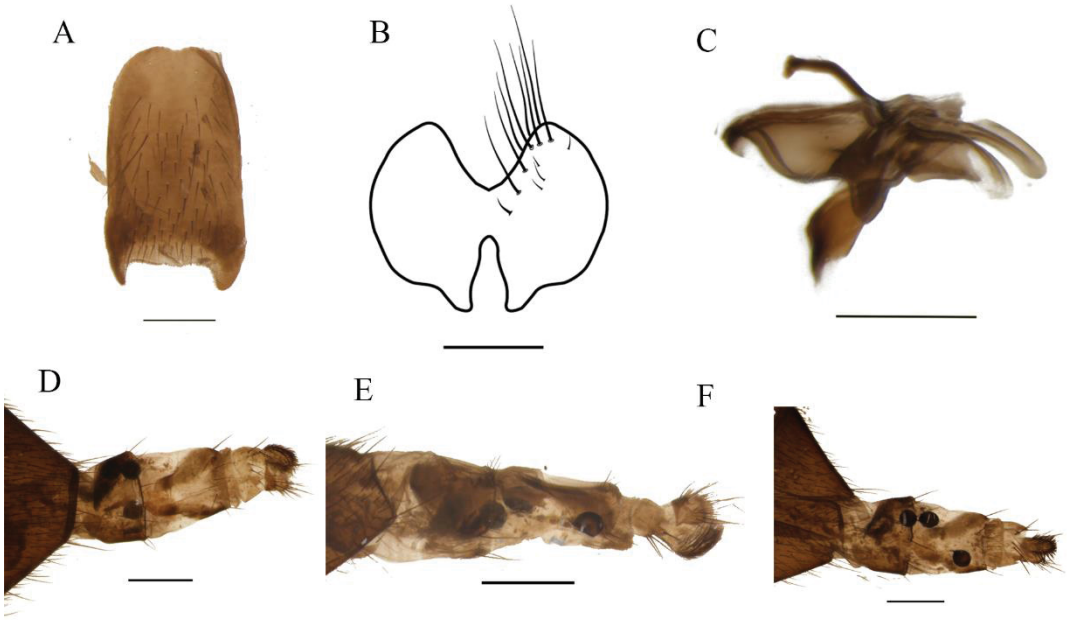

FIGURE 39. *Limnophora barbitarsis.* Male: **A.** Sternite 5. **B.** Cercus. **C.** Phallic complex, lateral view. Female, ovipositor: **D.** Dorsal view. **E.** Lateral view. **F.** Ventral view. Scale bars (**A**) = 0,3 mm. (**B, C**) = 200µm. (**E**, **F**) 500µm

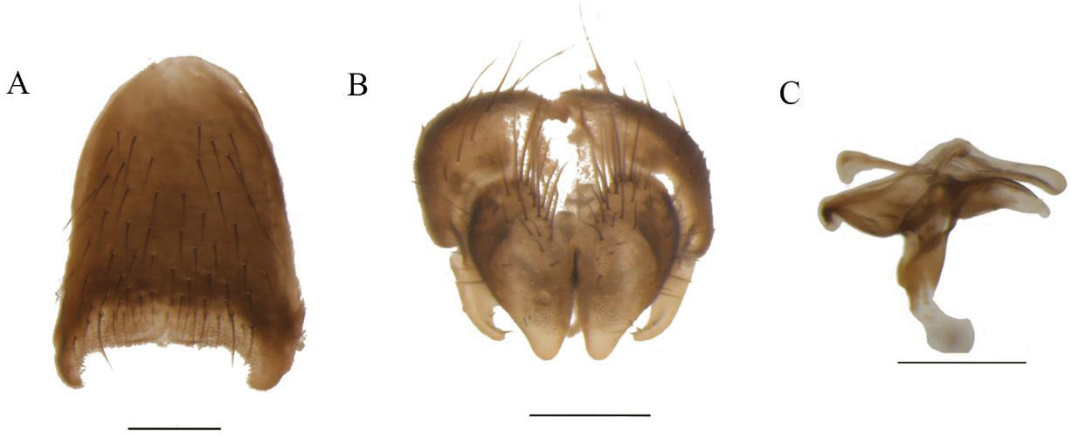

Figure 40. *Limnophora breviseta.* Male: **A.** Sternite 5. **B.** Cercus. **C.** Phallic complex, lateral view. Scale bars: 200µm

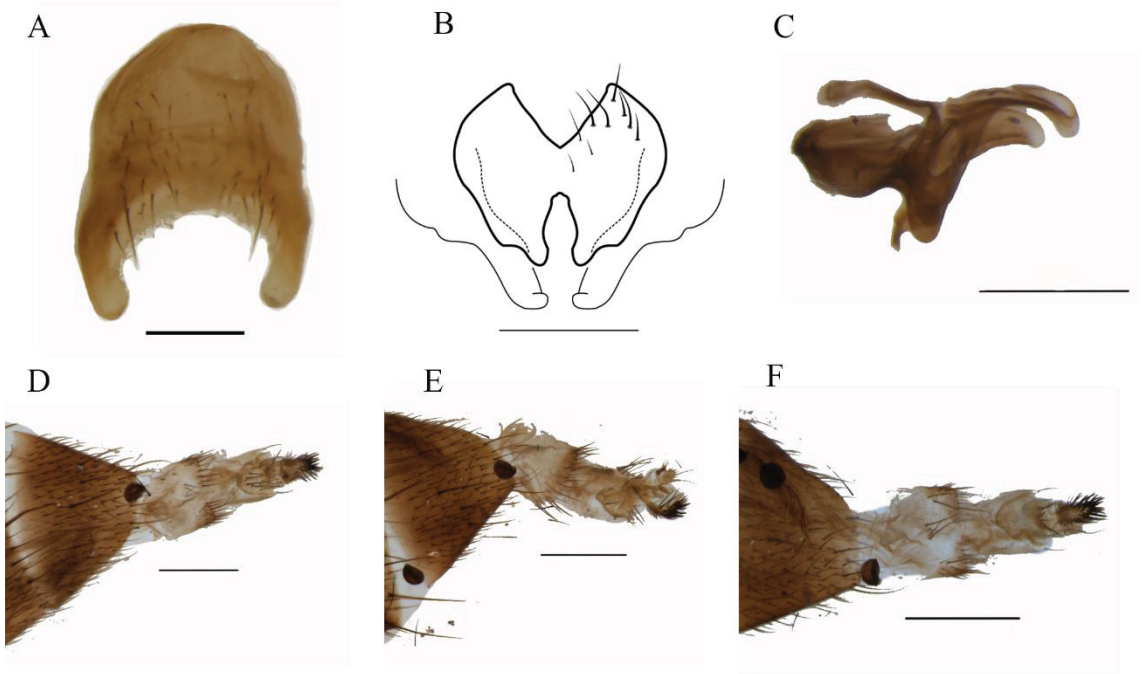

Figure 41. *Limnophora iniqua.* Male: **A.** Sternite 5. **B.** Cercus. **C.** Phallic complex, lateral view. Female, ovipositor: **D.** dorsal view. **E.** lateral view. **F.** ventral view. Scale bars (**A- C**) = 200µm. (**E-F**) 500µm

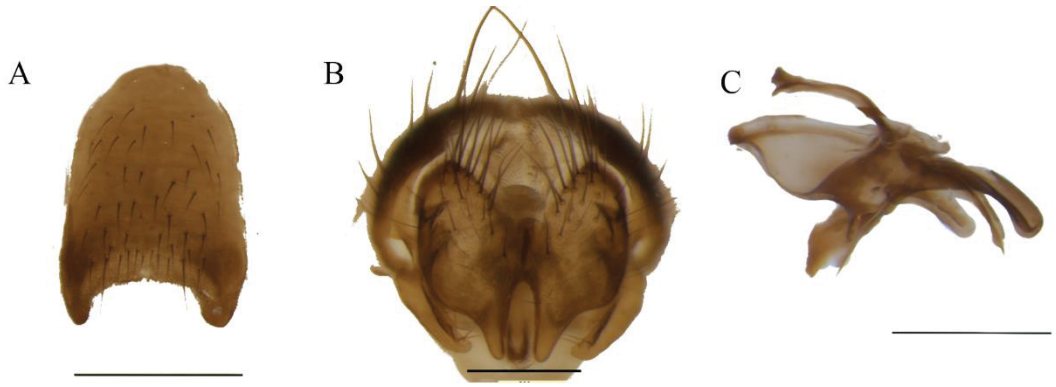

Figure 42. *Limnophora integra.* Male: **A.** Sternite 5. **B.** Cercus. **C.** Phallic complex, lateral view. Scale bars: (**A**) = 500 µm. (**B-C**) = 200µm

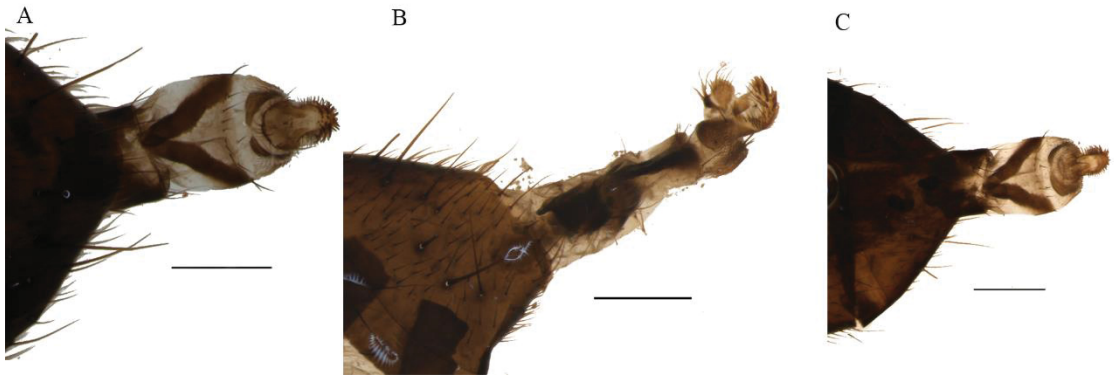

Figure 43. *Limnophora limbata.* Female: Female, ovipositor: **A.** dorsal view. **B.** lateral view. **C.** ventral view. Scale bars 500µm

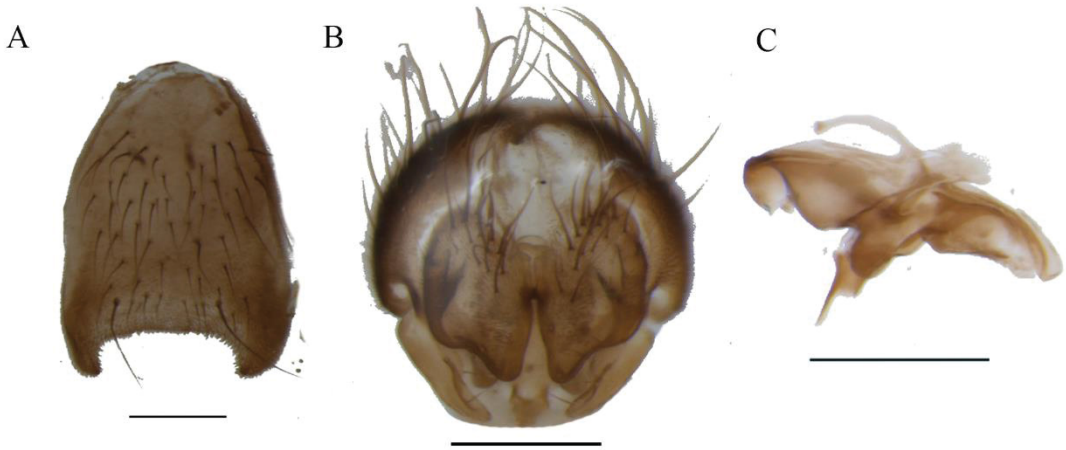

Figure 44. *Limnophora narona.* Male: **A.** Sternite 5. **B.** Cercus. **C.** Phallic complex, lateral view. Scale bars 200µm

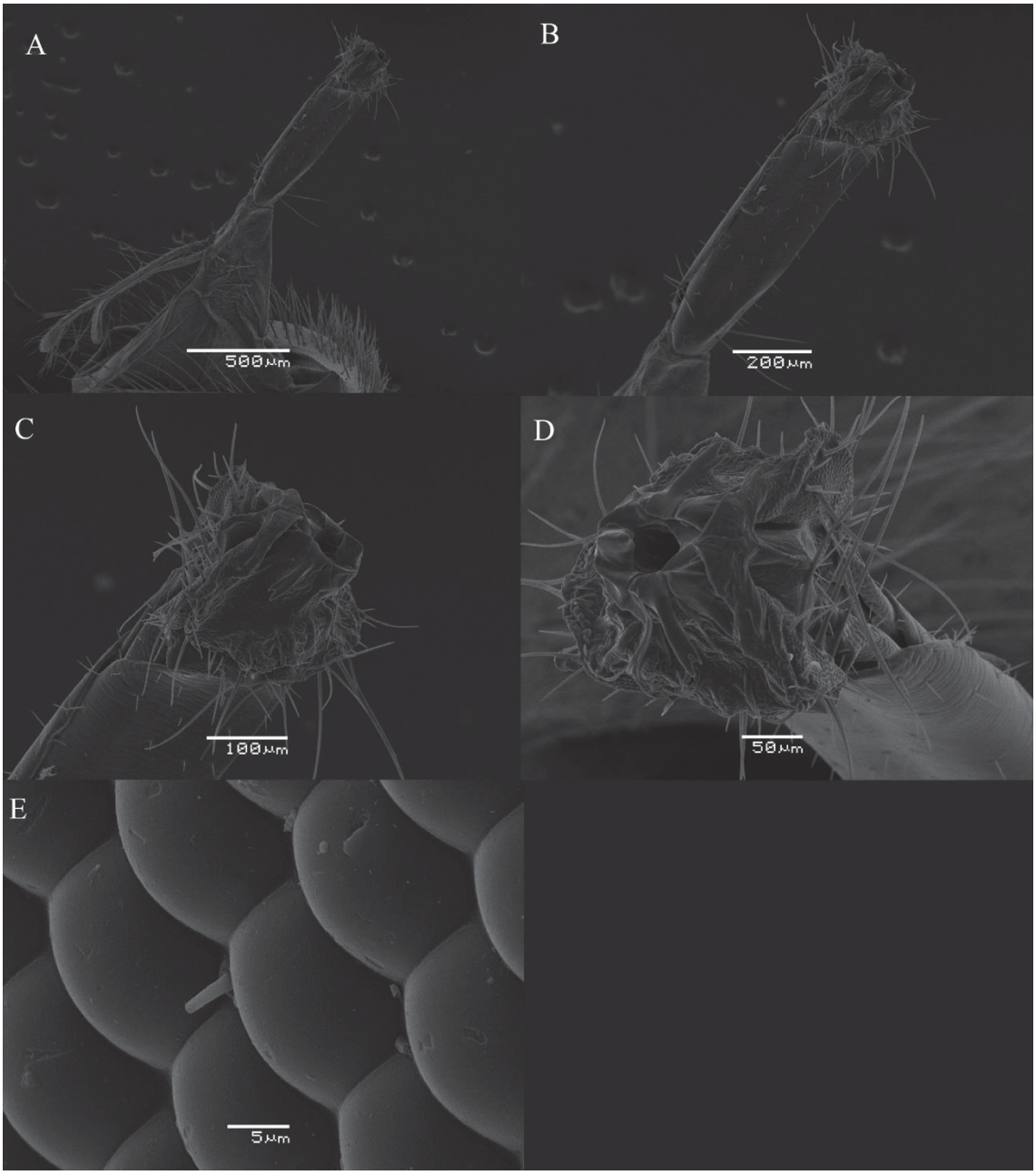

Figure 45. *Limnophora marginata.* Male, under a scanning electronic microscope (SEM): **A.** Proboscis and palpus, lateral view. **B.** Proboscis detail, lateral view. **C.** Labellum detail, lateral view. **D.** Prestomal teeth. **E.** Eyes, lateral view.

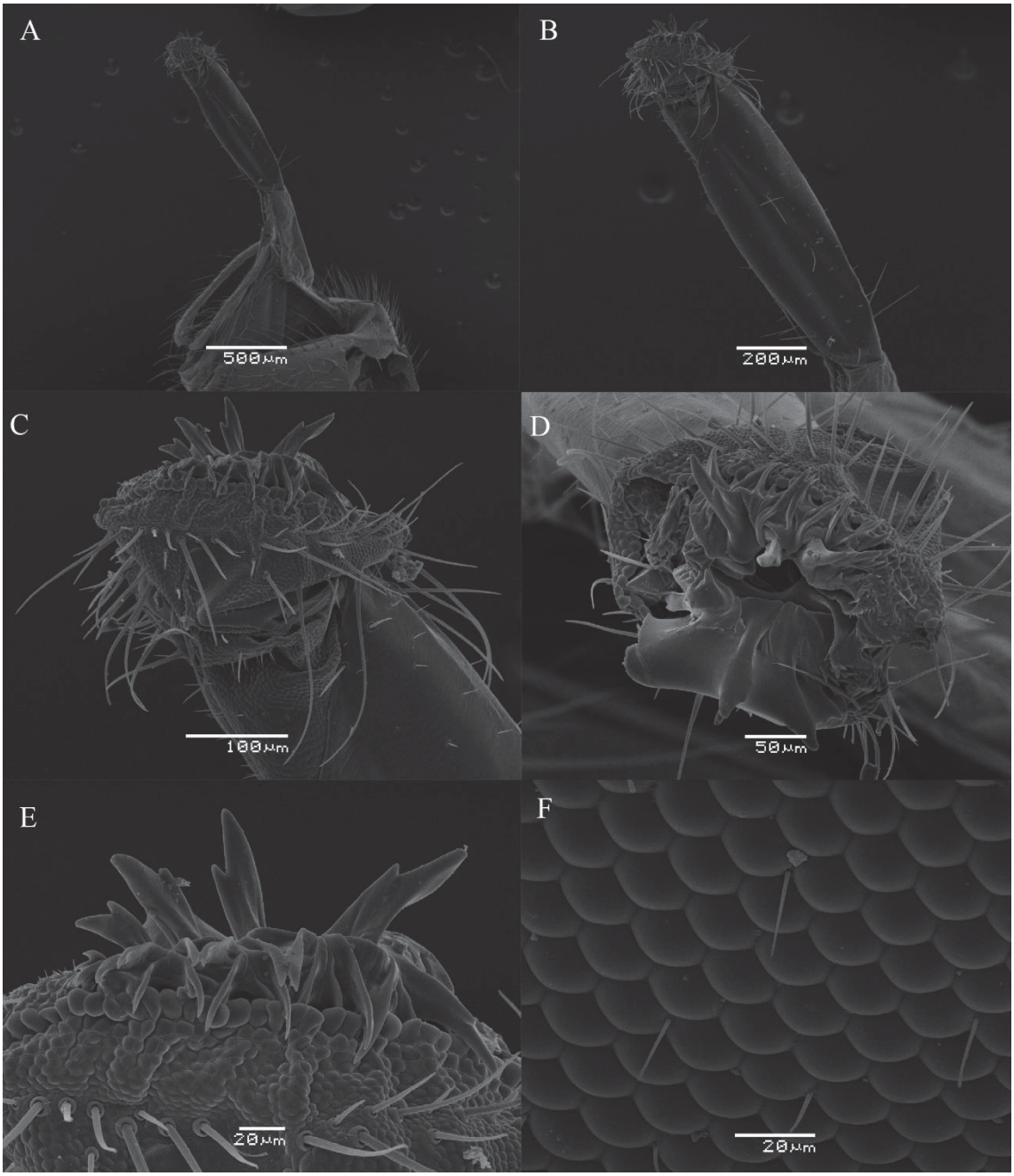

Figure 46. *Limnophora penai.* Male, under a scanning electronic microscope (SEM): **A.** Proboscis and palpus, lateral view. **B.** Proboscis detail, lateral view. **C.** Labellum detail, lateral view. **D.** Prestomal teeth. **E.** Prestomal teeth, lateral view. **F.** Eyes, lateral view

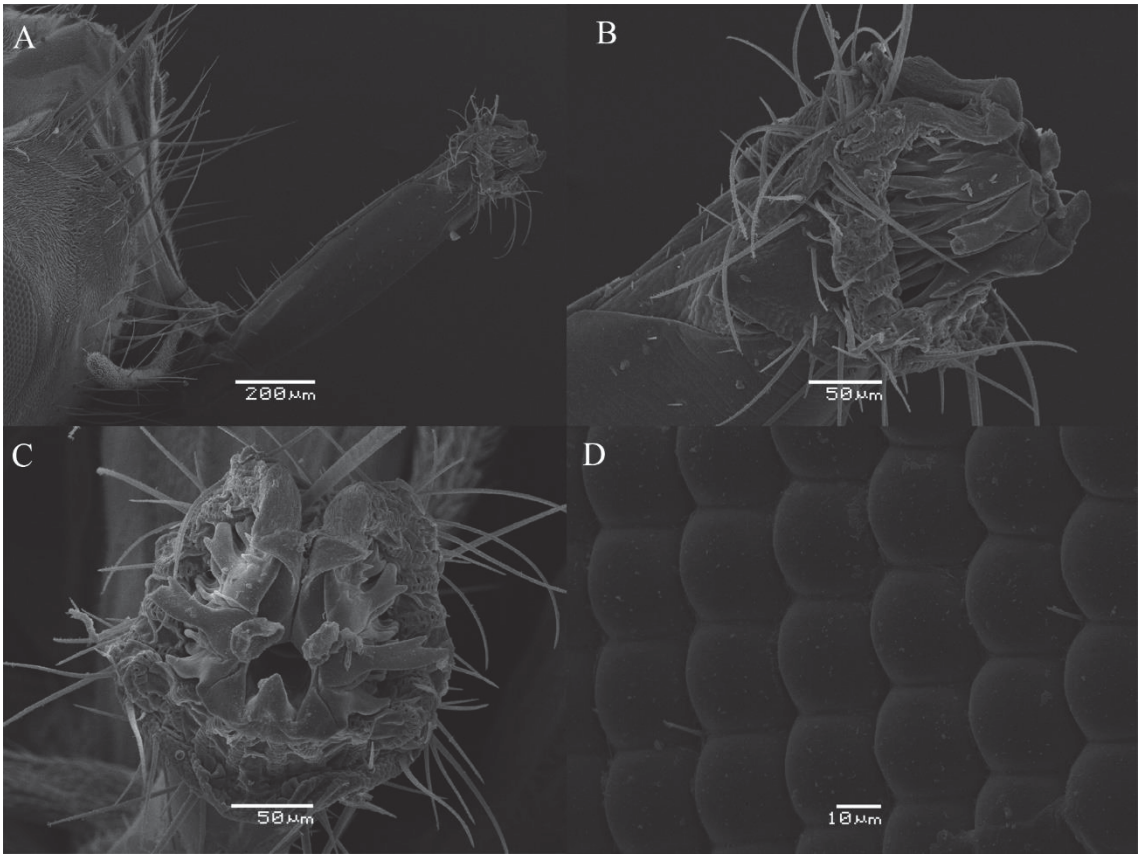

Figure 47. *Limnophora piliseta.* Male, under a scanning electronic microscope (SEM): **A.** Proboscis and palpus, lateral view. **B.** Prestomal teeth, lateral view. **C.** Prestomal teeth. **D.** Eyes, lateral view

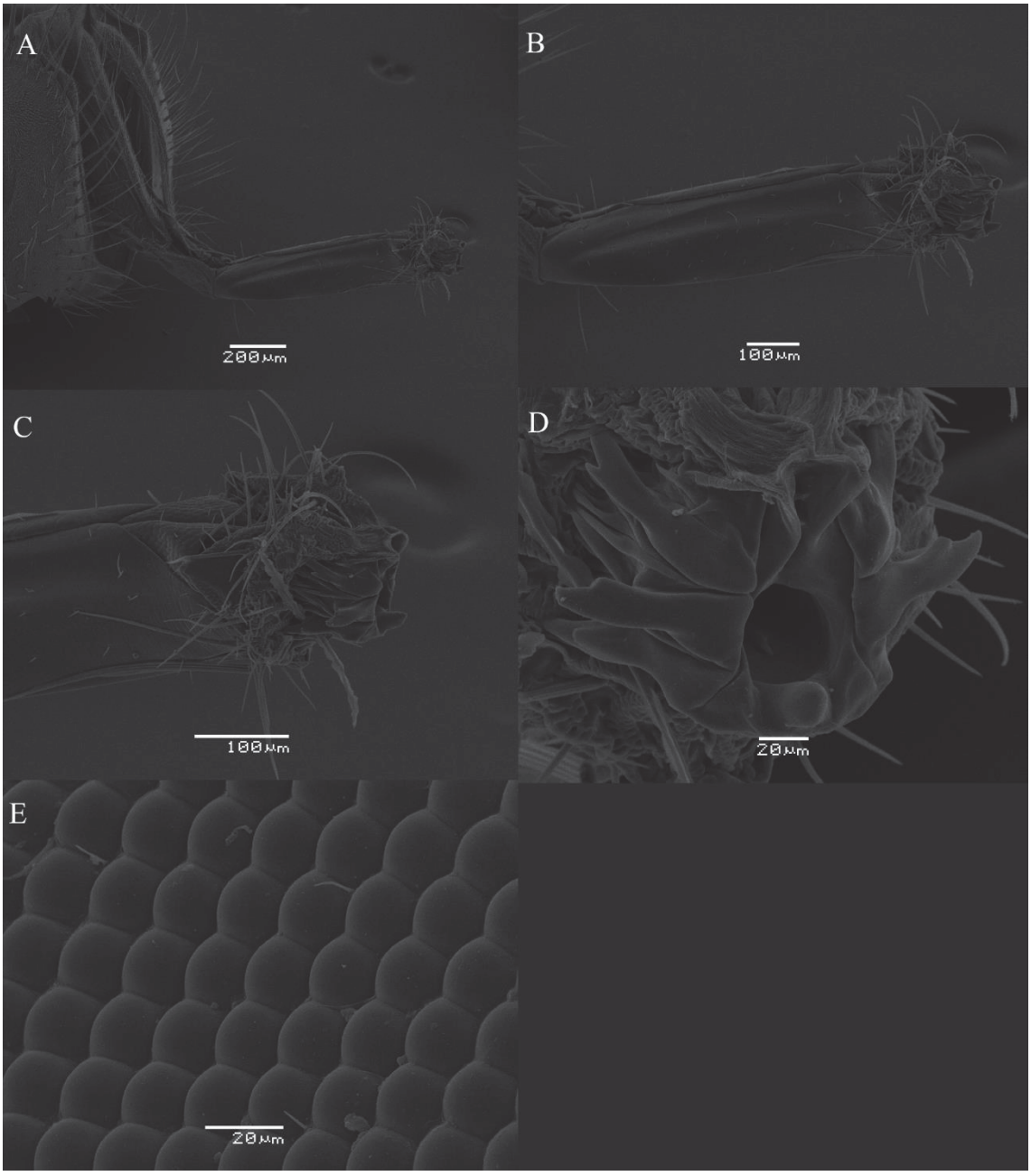

Figure 48. *Limnophora saeva.* Male, under a scanning electronic microscope (SEM): **A.** Proboscis and palpus, lateral view. **B.** Proboscis detail, lateral view. **C.** Labellum detail, lateral view. **D.** Prestomal teeth. **E.** Eyes, lateral view

CAPITULO III

A REMARKABLE NEW COENOSIINI GENUS (DIPTERA, MUSCIDAE) FROM COLOMBIAN PÁRAMOS

Enviado para publicação na revista Zootaxa.

A remarkable new Coenosiini genus (Diptera, Muscidae) from Colombian Páramos

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ABSTRACT

The new genus, *Sumapazomyia* **gen. nov**., is proposed for a new species, *S. inusitata* **sp. nov**., from National Natural Park Sumapaz, Bogota, Colombia. The unique morphology of the head and mouthparts, in combination with characters from the male and female terminalia, demonstrate that this new species represents a new and remarkable genus of the muscid tribe Coenosiini.

Key words: Altitude, morphological data, Coenosiinae, flower-visitor, ultrastructure.

INTRODUCTION

The Coenosiini, a tribe of Muscidae, includes 30 genera, some of which are distributed worldwide (de Carvalho et al. 2005). Coenosiini adults are characterized by the lower proepimeral seta directed downward and disposition of the katepisternal setae 1+1+1, forming an equilateral triangle (Couri & de Carvalho 2002). Coenosiini is a monophyletic group also supported by the position of katepisternal setae equidistant from each other (Couri & Pont 2000). The adults are predators of other small insects (Werner & Pont 2006). The larvae are generally monomorphic obligatory carnivorous (Skidmore 1985). There is no information on the larval biology of Coenosiini species from the Colombian Andes.

Given the significant biodiversity and the large number of endemic species, the tropical Andes should be considered a biogeographic hotspot (Myers et al. 2000; Madriñán et al. 2013). The fast evolution of the Páramos, three to five million years ago, has most likely

resulted in unique adaptations in the organisms that live there, and their study will certainly help to understand the processes of diversification in that region. (Madriñán et al. 2013).

During the study of the muscid material from the Páramos biome deposited at the Instituto de Investigación de Recursos Biológicos Alexander von Humboldt (IAvH), Colombia, we found some bizarre specimens with a peculiar morphology of the head and mouthparts which are not known among the Neotropical Muscidae. Here we described *Sumapazomyia* **gen. nov.** and *Sumapazomyia inusitata* **sp. nov.** from Colombia.

MATERIAL AND METHODS

Study area

The Sumapaz National Natural Park covers approximately 43% of the largest Páramos complex in the world. It is 223,179 hectares. This park has one of the richest high mountain sites and harbors a large number of organisms, many of which are endemic. The cold climate presents temperatures between 0°C to 20°C and the altitude between 700 to 4375 a.s.l. (Parques Nacionales de Colombia 2002).

Specimens and Terminology

The material belongs to the Instituto de Investigación de Recursos Biológicos Alexander von Humboldt (IAvH), Colombia.

The terminology for the external morphology and terminalia follows Cumming and Wood (2017). The following abbreviations were used: *a* – anterior, *d* – dorsal, *p* – posterior, *v* – ventral, *ad* – anterodorsal, *av* – anteroventral, *pd* – posterodorsal surface, *pv* – posteroventral.

Pinned dry specimens were examined under the stereomicroscope and the terminalia were examined after being removed from the abdomen, then cleared with cold potassium hydroxide, transferred to acetic acid, dehydrated in 70% alcohol and then placed in glycerin. The terminalia were dissected, analyzed and were illustrated under the optical microscope with the help of a camera lucida. After examination, the terminalia were stored in microtubes that were fixed to the original pinned specimen. The label of holotype of the new species is coded in which a backslash indicates the end of a line, and a quotation mark indicates the beginning and the end of label.

The locations where specimens were collected (country, locality, longitude, latitude) were extracted from the original specimen labels. The map was generated using QGIS 2.18.17

(http://www.qgis.org/en/site/), the biogeographical regions follow Morrone (2015), and shapefile used in this study was available by Löwenberg-Neto (2015).

Scanning electronic microscope (SEM) images were taken using a JEOL JSM 6360-LV at Centro de Microscopia Eletrônica, Curitiba, Paraná, Brazil, Universidade Federal do Paraná.

RESULTS

Taxonomy

Genus *Sumapazomyia* gen. nov.
(Figs 1A–D, 2A–E, 3A–C, 4A–C, 5A–G, 6A–D, 7, 8, 9)

Type species: *Sumapazomyia inusitata* **sp. nov.** (here designated).

Diagnosis

Male dichoptic; parafacial and gena wide, eye setulose, with sparse, short and fine setulae (Fig. 5C, E–G), separated by about 1/5 of head width in both sexes (Figs 1D, 5C); palpus slender, very short, length equal to length of antenna; proboscis not adapted for predation, prementum shiny with a few and sparse setulae (Fig. 5B), labellum well developed, modified and prestomal teeth not well developed (Fig. 6C); proepimeral seta oriented downwards; presutural acrostichal setae developed; dorsocentral setae 1+3; katepisternal setae 1+1+1 forming an imaginary equilateral triangle; upper calypter short, lower calypter elongate, about 1.5–2.0X length of upper calypter; wing veins bare; hind tibia (Fig. 7) with three *ad* and three *pv* setae placed opposite one another, one supramedian and one submedian *d* and *av* setae, *ad, pd* and *av* surfaces with a preapical setae; sternite 1 bare; sternite 5 triangular with two big lateral setae; male hypandrium tubular; ovipositor long, straight and with microtrichia.

Etymology

The generic name is a junction of "Sumapaz", refers to the type locality, "o" as linking vowel and "*myia*" is Greek for "fly".

***Sumapazomyia inusitata* sp. nov.**
(Figs 1A–D, 2A–E, 3A–C, 4A–C, 5A–G, 6A–D, 7, 8, 9)

Type material

Holotype: Male. "Cocun \ PNN Sumapaz/ Bocatoma Cerro El Zapato \ 4° 14' N; 74° 12' W \ 3560 msnm \ Malaise \ Nov 6-7/ 2002 \ IAvH (white printed label)" (IAvH). Paratypes: 1 female. Same data as holotype (IAvH).

Additional examined material

Three females, same data as holotype (IAvH).

Description

Coloration. Ground color grey. Frons and fronto-orbital plate dark brown. Parafacial and gena grey pollinose. Ocellar triangle dark brown. Antenna, arista and palpus dark brown. Mesonotum brown. Pleurae grey. Calypter whitish. Halter yellowish. Wing light brown. All legs grey, femora weak brown pollinose in the apex. Abdomen grey with brown pollinose on center areas of tergites 2–5.

Male. Body length: 4 mm (holotype).

Head (Figs 1B, D). Ocellar triangle narrow, extending to the ptilineal suture. Five pairs of frontal setae; upper orbital seta only one pair; ocellar setae well developed; postocellar setae same length as ocellar pair; inner convergent and outer divergent vertical setae shorter than ocellar setae. Antennae (Fig. 1B). Postpedicel measuring about 1.5 length of pedicel. Arista long, larger on basal fourth, shortly pubescent.

Thorax (Fig. 1C). Postpronotal lobe, presutural scutum, postsutural scutum and scutellum with a few setulae. Acrostichal pre-sutural setae differentiated, arranged in four pairs of setae; intralar setae 1+2; basal postpronotal setae 2; supra-alar setae 1+1; intrapostalar seta developed. Notopleuron with 2 similar setae, without cilia covering it. Scutellum with sub-basal and an apical pair of strong setae. Prosternum bare; proepisternum, proepimeron bare; anepisternum setulose near notopleuron; anepimeron bare; katerpisternum and katepimeron bare; meron bare.

Wing (Fig. 8). Long, slender, anal lobe weakly developed. Vein R_{4+5} and M_1 parallel on apical part; vein *dm-cu* almost straight; vein CuA_2+A_1 short; vein A_2 long and weak.

Legs (Fig. 7). Fore femur with *d*, *pv*, *p* and *pv* complete rows of setae. Fore tibia with a median *p* setae well developed and 3 apical setae (*d*, *pd* and *pv*). Mid femur with irregular *ad*, *av* and *v* rows of setae, longer on apical half and 2 pre-apical setae on *pv* surface. Mid tibia with 1 median seta on *d* and *ad* and 5 apical setae (*d*, *pv*, *p*, *v* and *av*). Hind femur with irregular *ad*, *av* and *pv* rows of setae, longer on apical half.

Abdomen (Figs 1A, C). Longer than thorax. Tergites I–IV with developed lateral setae at disc and apex, tergites IV and V with a complete row of setae at disc and apex. Sternite 5 setulose, more concentrated on the lobes (Fig. 2A).

Terminalia (Figs 2B–E). Epandrium large and divided in the center; cercus setulose, longer than wide (Fig. 2E); surstylus long, about the same length of cercus (Fig. 2C). Phallic complex: hypandrium short tubular; praegonite long, longer than wide; postgonite short with membranous apex; epiphallus long and curved; distiphallus membranous on apex; phallapodeme long and curved on apex (Fig. 2D).

Female: Body length: 4.2 mm.

Similar to male.

Terminalia (Figs 4A–C). Ovipositor long with microtrichia on sternites 6, 7 and 8; segment 8 without spicules; cerci medium to long and slender; segments 6 and 7 not fused; epiproct well developed; hypoproct not modified, setulose, at most twice as high as wide; tergites 6 and 7 two intermediate to slender plates; 3 spermathecae.

Distribution

The new genus is only known from the type locality. Some species of *Coenosia* Meigen, 1826 and *Neodexiopsis* Malloch, 1920 (Fig. 9) are found in the same Paramo province of *Sumapazomyia inusitata* **sp. nov**.

Biology

Unknown. Many authors have discussed characters of the head and mouthparts of muscids. More specifically, Hennig (1965) considered that some characters on the head and mouthparts of flower-visiting species could be associated with their biology. Flower visitors, especially those occurring in high altitudes, tend to have the gena enlarged, resulting in longer parafacials. These characteristic are found in *Sumapazomyia inusitata* **sp. nov**.

Etymology

The specific name refers to the strange morphology of the head and mouthparts.

DISCUSSION

In the current classification of Muscidae, *Sumapazomyia* belongs to Coenosiini (Couri & Pont 2000). However, *Sumapazomyia* presents unusual features to Coenosiini as parafacial and gena wide, palpus short (Figs 5B, 6A), labellum well developed and modified (Fig. 6A–

D) and prestomal teeth weakly developed, what makes these genus, unique among the Coenosiini. In the key to World Coenosiini Couri & Pont (1999) and to Neotropical Muscidae de Carvalho & Couri (2002), the new genus keys out near *Stomopogon* Malloch, 1930. Besides that, in the key to Central Muscidae Savage & Vockeroth (2010), which does not include *Stomopogon*, the new genus keys out near *Neodexiopsis* Malloch, 1920.

ACKNOWLEDGEMENTS

We thank Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq) provided a scholarship and grant (processes number 140250/2015–8, JMF, 300382/2010–3, MSC and 309873/2016–9, CJBC); Taxonline—Rede Paranaense de Coleções Biológicas for specimen images; Lucas R. P. Gomes (UFPR) for help with images and map.

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FIGURES

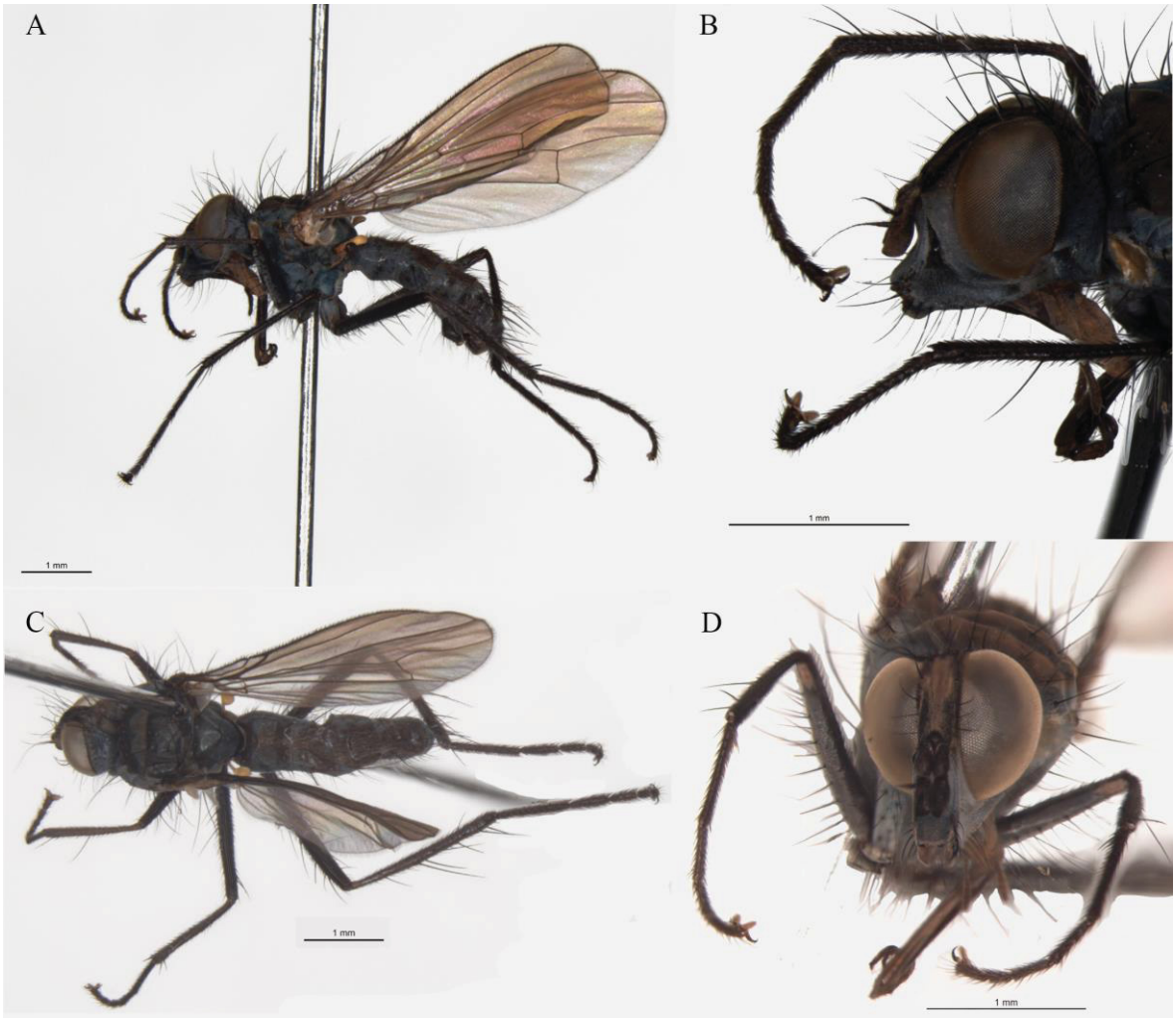

Figure 1. *Sumapazomyia inusitata* **sp. nov.** A–D. Male holotype. A. Lateral view. B. Head, lateral view. C. Dorsal view. D. Head, Frontal view.

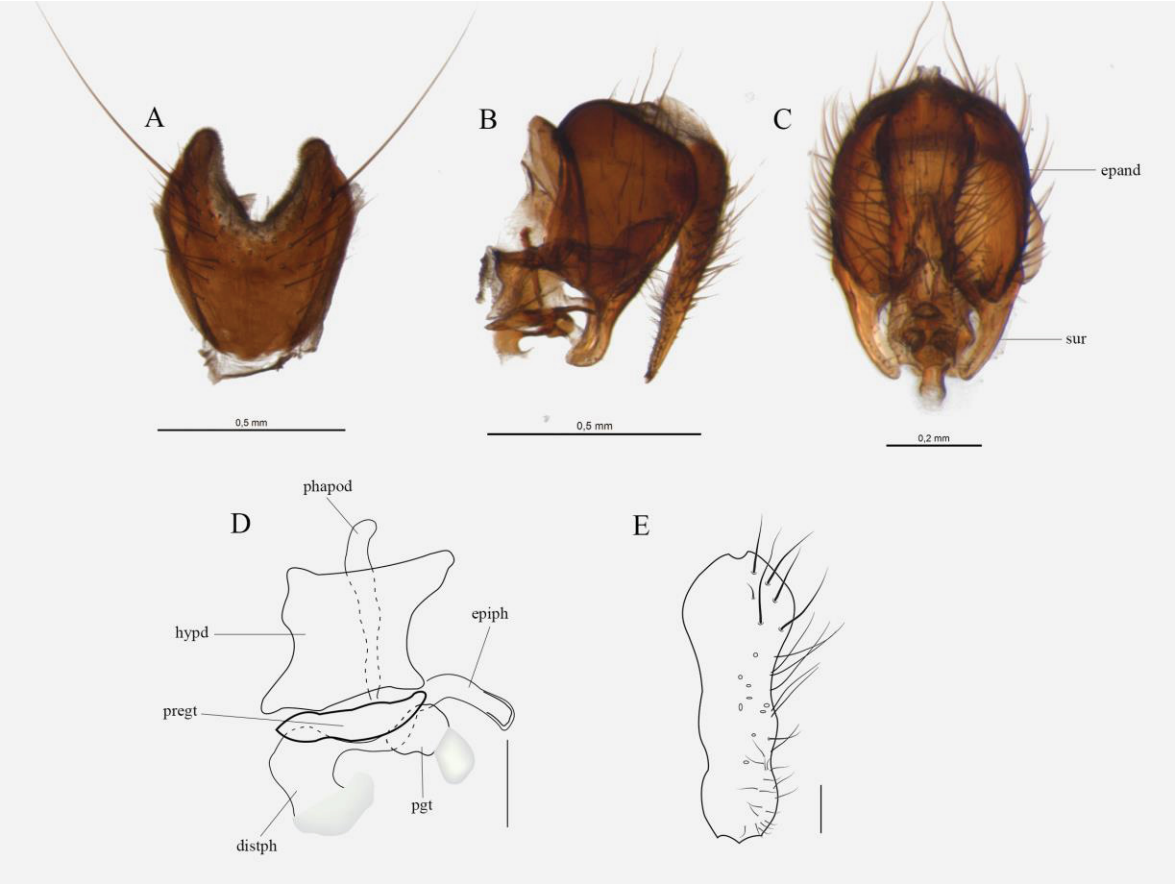

Figure 2. *Sumapazomyia inusitata* **sp. nov.** A–E. Male holotype. A. Sternite 5, dorsal view. B. Terminalia, lateral view. C. Terminalia, dorsal view. D. Phallic complex, lateral view. E. Cercus, dorsal view. D. and E. scale 0.1mm.

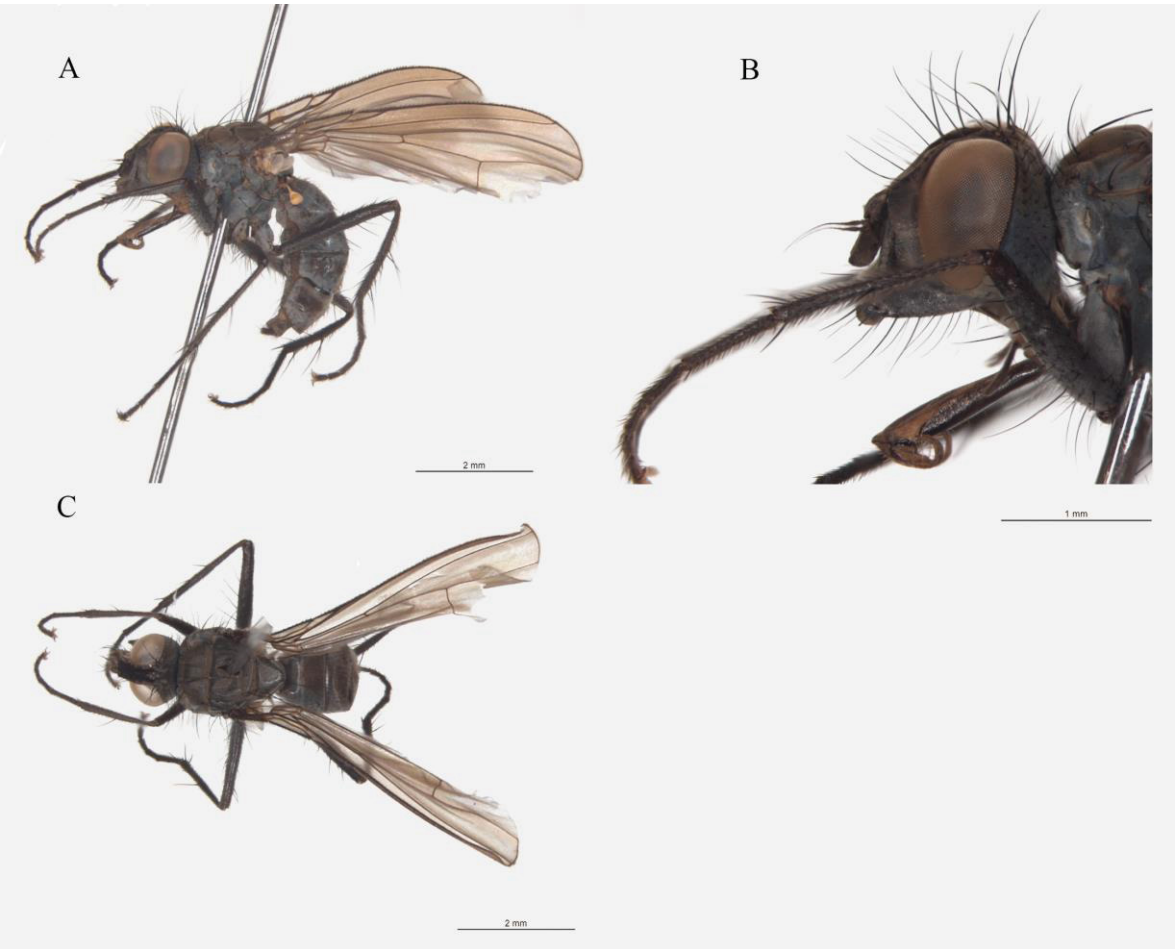

Figure 3. *Sumapazomyia inusitata* **sp. nov.** A–C. Female paratype. A. Lateral view. B. Head, lateral view. C. Dorsal view.

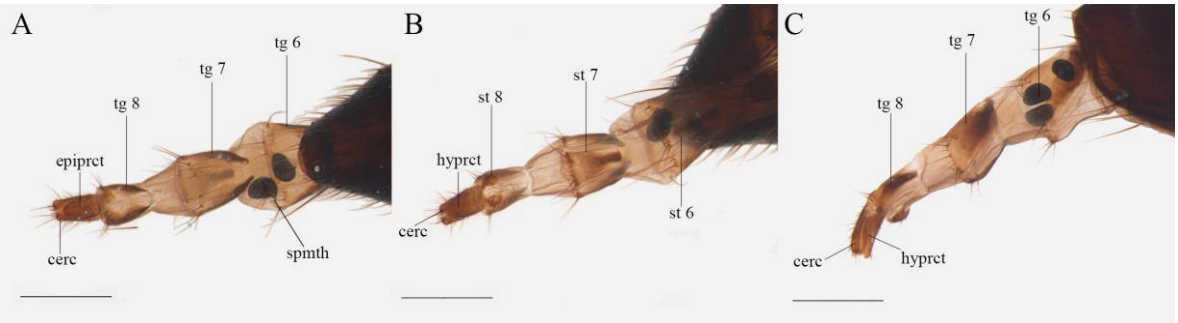

Figure 4. *Sumapazomyia inusitata* **sp. nov.** A–C. Female paratype terminalia. A. Dorsal view. B. Ventral view. C. Lateral view.

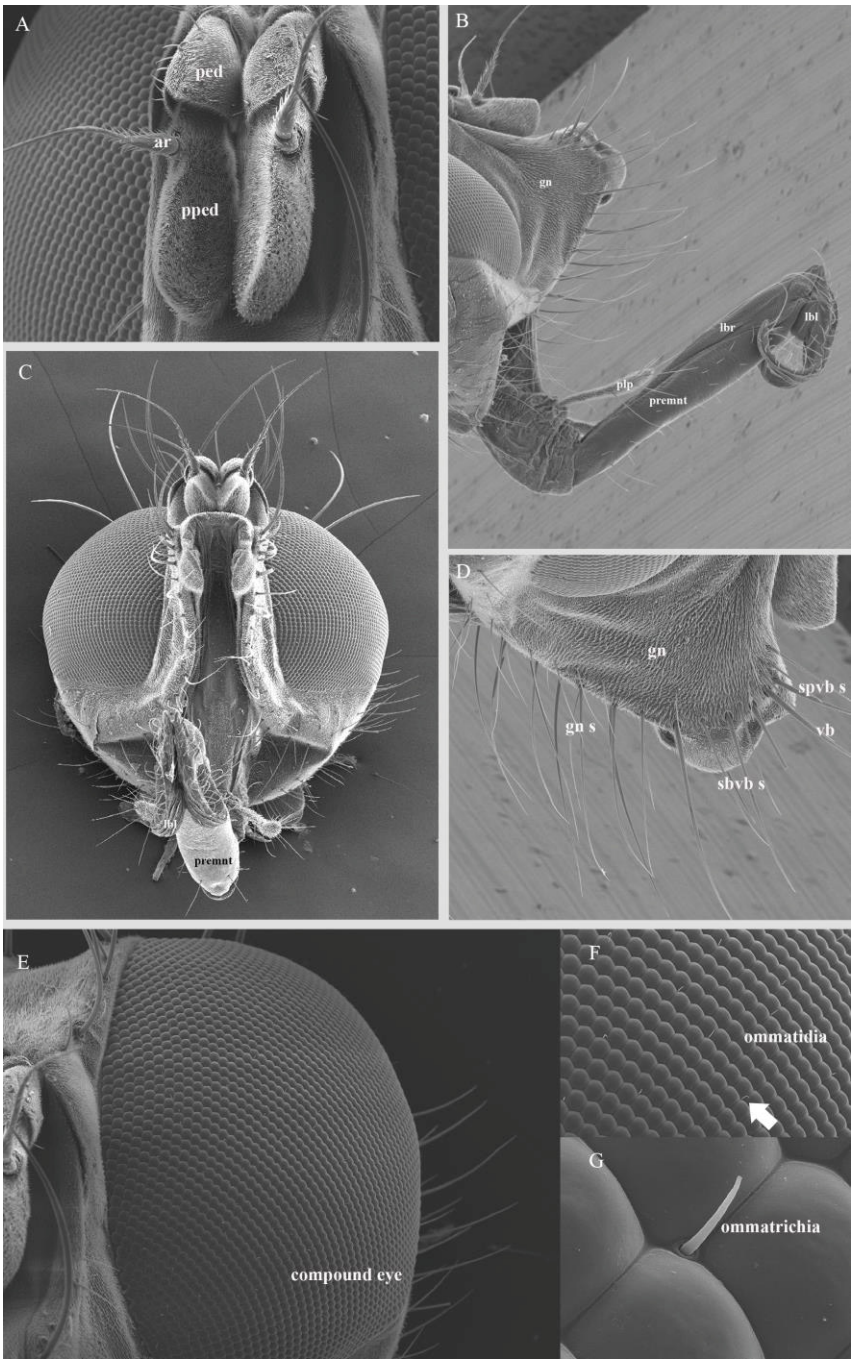

Figure 5. *Sumapazomyia inusitata* **sp. nov.** A–C. Female paratype. A. Antennae, frontal view. B. Gena, lateral view. C. Head, frontal view. D. Gena detail, lateral view. E. Eyes, frontal view. F-G, Eyes details, frontal view. (Abbreviations: ar, arista; gen s, genal setae; gn, gena; lbl, labellum; lbr, labrum; ped, pedicel; plp, palpus; pped, postpedicel; premnt, prementum; sbvb s, subvibrissal seta; spvb s, supravibrissal seta; vb, vibrissa).

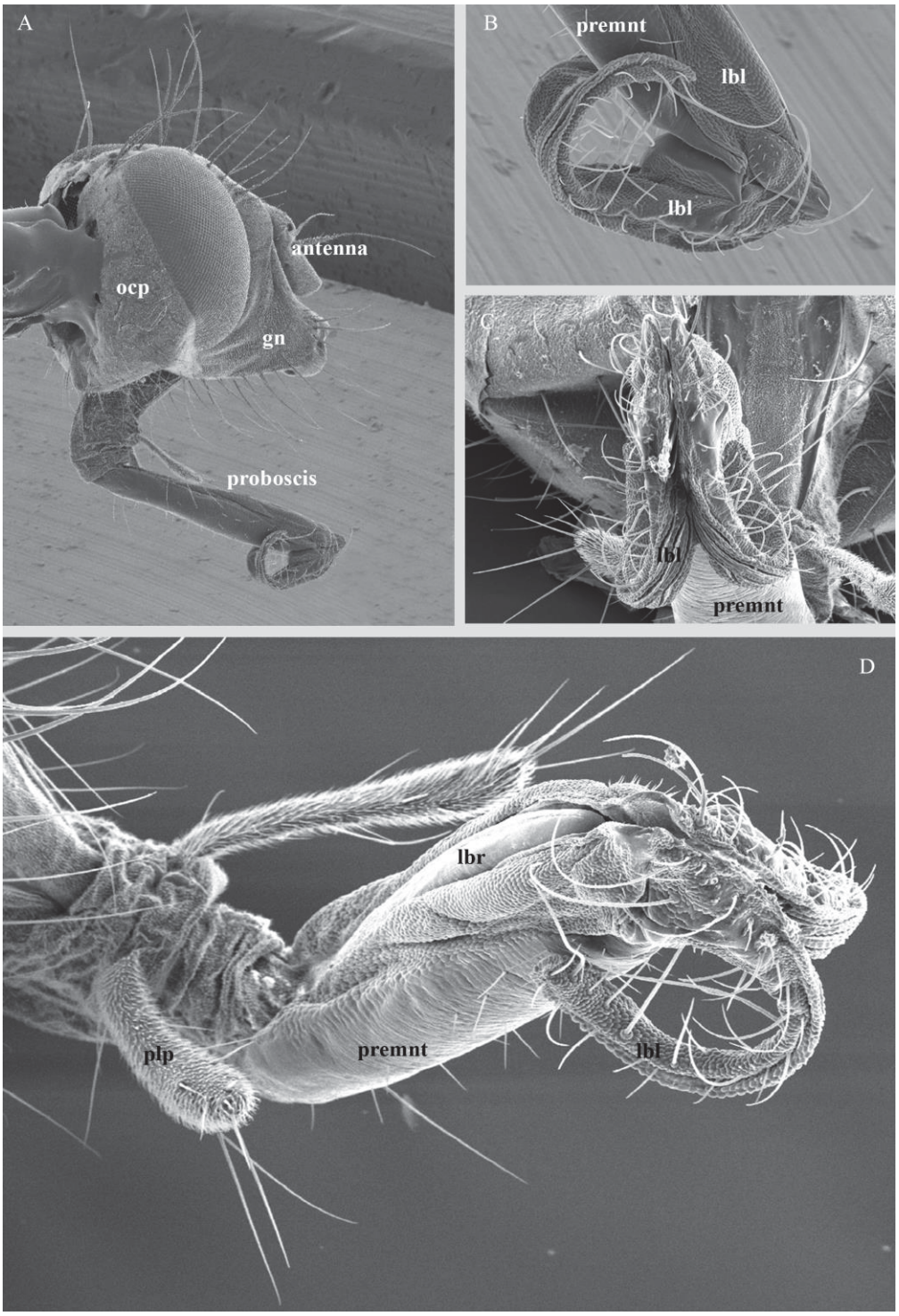

Figure 6. *Sumapazomyia inusitata* **sp. nov.** A–C. Female paratype. A. Head, lateral view. B. Labellum detail, lateral view. C. Labellum detail, frontal view. D. Proboscis detail, lateral view. (Abbreviations: gn, gena; lbl, labellum; lbr, labrum; ocp, occiput; plp, palpus; premnt, prementum).

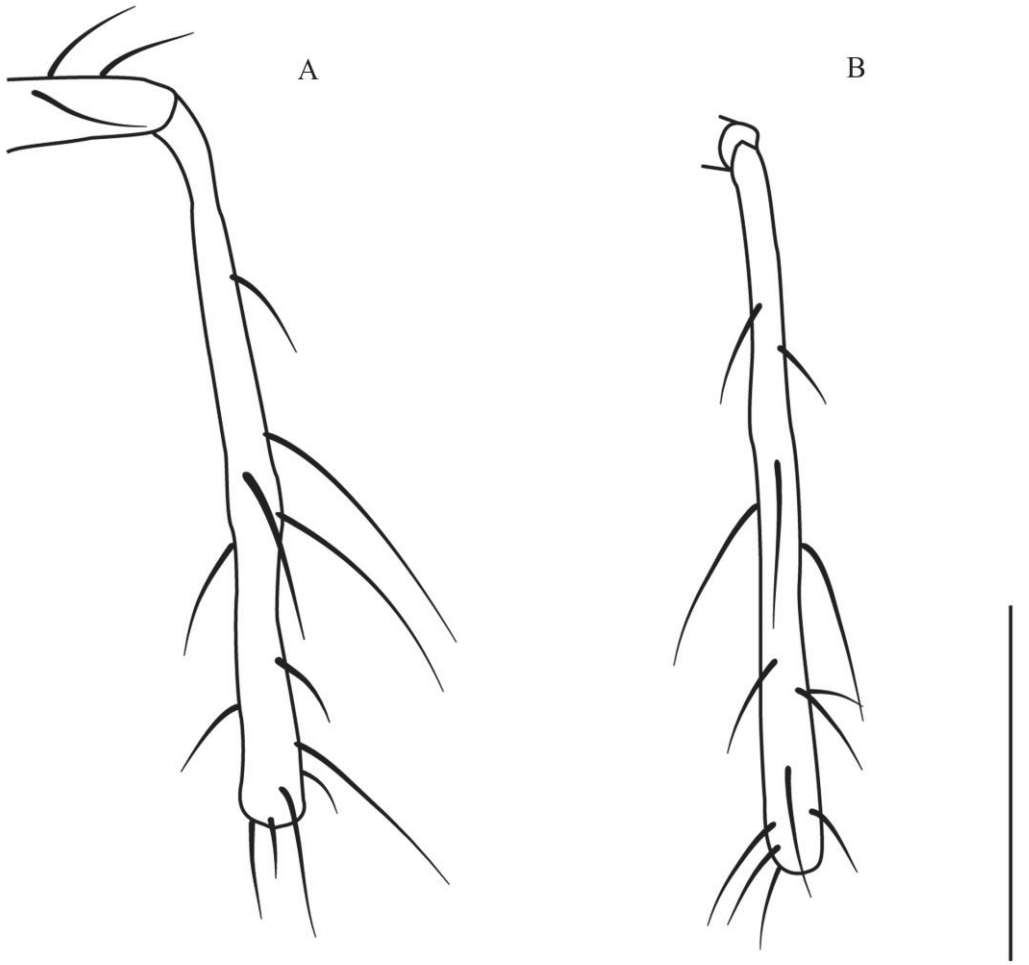

Figure 7. *Sumapazomyia inusitata* **sp. nov.** Male holotype. A. Hind tibia, lateral view. B. Hind tibia, dorsal view. Scale 0.1mm.

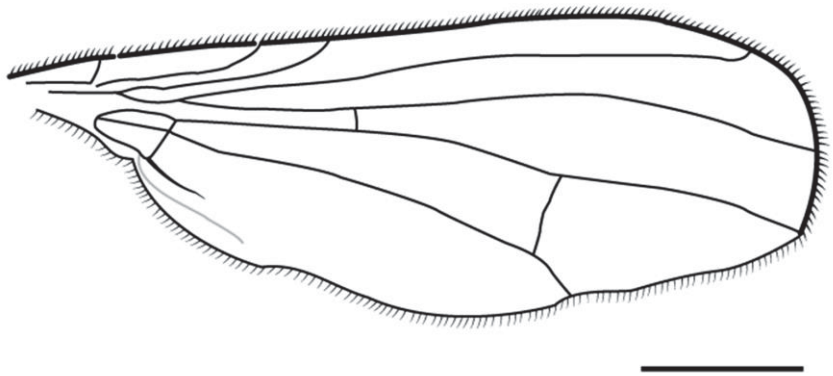

Figure 8. *Sumapazomyia inusitata* **sp. nov.** Male holotype. A. Wing, lateral view. Scale 0.1mm.

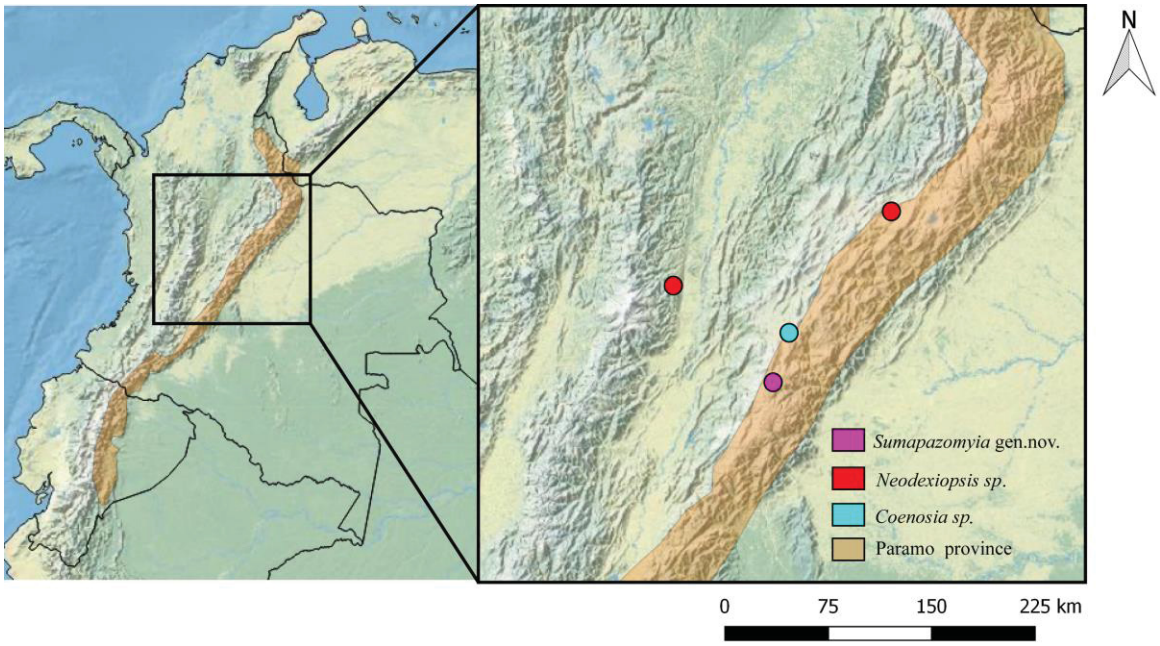

Figure 9. Coenosiini Map. Distribution of some Coenosiini genera in Paramo province (Morrone 2015).

CAPITULO IV

A REMARKABLE NEW SPECIES OF *NEODEXIOPSIS* (MUSCIDAE, DIPTERA) FROM SOUTH BRAZIL, INCLUDING DNA BARCODE AND ULTRASTRUCTURAL MORPHOLOGY

A remarkable new species of *Neodexiopsis* (Muscidae, Diptera) from South Brazil, including DNA barcode and ultrastructural morphology

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ABSTRACT

A new Muscidae, *Neodexiopsis omnicapilli* sp. nov. (Diptera, Muscidae), from Palmas, Paraná, Brazil, is described and illustrated. The proboscis and male and female terminalia are described using ultrastructural morphology. This new species resembles a member of the Scathophagidae, while the male and female terminalia have the typical Coenosiini morphology. A neighbor-joining (NJ) analysis of the *Cytochrome c oxidase subunit I* (COI) sequences is presented, including new species and four other species of *Neodexiopsis* found in the same locality, added with two other sequences from GenBank. *Neodexiopsis omnicapilli* sp. nov. and *N. rava* (new record to Brazil) are included in the available South American species key to the genus. The distributional data of *Neodexiopsis* species from Brazil is included.

Keywords**:** biodiversity, molecular evidence, Neotropical Region, Palmas-PR, taxonomy,

INTRODUCTION

Neodexiopsis Malloch, 1920 is one of the richest genera of the Neotropical Coenosiini with 97 species, including 48 species from Brazil (de Carvalho *et al*., 2005; Löwenberg-Neto and de Carvalho, 2013). Adults are small to medium sized predatory flies that inhabit forests or pastures (Costacurta *et al*., 2005). The biology of *Neodexiopsis* species is unknown and the only reference to the immature stages is a larva found in the gallery of a beetle in the bark of a

pine tree (Savage and Vockeroth, 2010). The genus taxonomy is unclear, and several species are known only by the female (Costacurta *et al*., 2005).

Couri and Pont (2000), in a cladistic analysis of Coenosiini, failed to find synapomorphic characters for the genus. Some keys to *Neodexiopsis* are available (Snyder, 1957a, b; 1958; Couri and Albuquerque, 1979, Couri and Pont, 1999; Couri and de Carvalho, 2002; Costacurta *et al*., 2005). The ultrastructural morphology of the egg and proboscis of *Neodexiopsis rufipes* (Macquart, 1851) was illustrated by Patitucci and Couri (2018) through SEM images.

Herein, we describe *Neodexiopsis omnicapilli* sp. nov., including images, drawings and ultrastructural morphology by scanning electron microscope (SEM) of the genitalia and proboscis of *Neodexiopsis*. In addition, we updated the identification key to the South American species of *Neodexiopsis* by including *N. omnicapilli* sp. nov. and *N. rava* (new record to Brazil). Finally, we added sequences of the *Cytochrome c oxidase subunit I* (COI) sequences of *Neodexiopsis* and inferred that the *N. omnicapilli* sp. nov. belongs to *Neodexiopsis,* using the neighbor-joining (NJ) method (Saitou and Nei, 1987). This analysis was carried out with COI sequences and from our material of *Neodexiopsis* from the Palmas Wildlife Refuge (PWR) and also GenBank sequences.

MATERIAL AND METHODS

The specimens were collected using Malaise trap at the Palmas Wildlife Refuge (PWR), a full protection conservation unit located in Palmas, state of Paraná, south Brazil. The specimens were deposited at the Entomological collection Padre Jesus Santiago Moure, Department of Zoology of Universidade Federal do Paraná. Curitiba, Paraná, Brazil (DZUP).

The terminology for the external morphology and terminalia follows Cumming and Wood (2017). The following abbreviations were used in diagnoses, key and figures: *a* – anterior, *d* – dorsal, *p* – posterior, *v* – ventral, *ad* – anterodorsal, *av* – anteroventral, *pd* – posterodorsal, *pv* – posteroventral, *ap sctl s* – apical scutellar seta*, dc s* – dorsocentral seta, *cerc* – cercus, *fr s* – frontal seta, *ial s* – intra-alar seta, *i vt s* – inner vertical seta, *kepst s* – katepisternal setae*, o vt s* – outer vertical seta*, oc s* – ocelar seta*, poc s* – postocelar seta*, prepm s* – proepimeral seta*, prepst s* – proepisternal seta, *presut dc s* – presutural dorsocentral seta*, psut dc s* – postsutural dorsocentral setae*, psut ial s* – postsutural intra-alar seta*, sbvb s* – subvibrissal seta, *spvb s* – supravibrissal seta*, sbsctl* – subscutellar seta, *vb* – vibrissal seta.

For analysis of the genitalia of the male, the abdomen was removed and was placed in cold potassium hydroxide (KOH) 10% for 24h to soften and lighten the parts, then it was transferred to acetic acid, and finally to glycerin. The postabdominal structures were separated from the rest of the abdomen. Examination and illustration of the structures were carried out using a microscope and a stereomicroscope with a camera lucida attached to it. Dissected terminalia were placed in glycerin, inside microvials pinned beneath the respective specimens. The SEM examination of the proboscis and terminalia were carried out after detaching the head and terminalia, and dehydrating those parts through 99.5% ethanol, glued on cooper tape and coated with gold-palladium. After the study, the dissected parts were placed in a plastic microvials with glycerin and were added to their respective specimen's pin.

Images were stacked using an auto-montage setup acquired by the Taxonline project (UFPR – http://taxonline.ufpr.br/). (UFPR). Scanning electronic microscope (SEM) images were taken using a JEOL JSM 6360-LV at Centro de Microscopia Eletrônica, Curitiba, Paraná, Brazil, (UFPR – http://www.cme.ufpr.br/).

DNA extraction was conducted through a nondestructive method, using the whole specimen with body perforations and the GenElute™ Blood Genomic DNA Kit. The complete sequence primers used were LCO-1490f: 5' GGT CAA CAA ATC ATA AAG ATA TTG G 3', and HCO-2198r: 5' TAA ACT TCA GGG TGA CCA AAA AAT CA 3'(Folmer, 1994). The kit MyTaq™ DNA Polymerase (Bioline Reagentes Ltd, United Kingdom) was used for the PCR amplification and the 25 µL reaction consisted of 17.5 µL of sterilized ultrapure water, 5 µL 5x MyTaq Reaction Buffer (comprising 15mM $MgCl_2$ and 5 mM dNTPs), 0.5 µL of Primers each, 0.2 µL of MyTaq DNA Polymerase, and 1.0 µL of DNA extracted from the specimen. The PCR amplification conditions were as follows: 94°C for 5 min, 39 cycles at 94°C for 45 s, 51°C for 50 s and 72°C for 2 min, and a final extension at 72°C for 10 min. The PCR products were visualized on a 1.0% agarose gel. PCR products were sent to WenSeq Pesquisa e Desenvolvimento Ltda (Curitiba, Brazil) for sequencing.

Neighbor-joining (NJ; Saitou and Nei, 1987) was chosen because it is the best-performing method (among phylogenetic, simple distance-based and supervised statistical classification methods) for small samples (Austerlitz *et al*., 2009). The sequences were aligned in ClustalW (Thompson *et al*., 1994) using MEGA7 (Kumar *et al*., 2016). The NJ tree was constructed using the Kimura-2-Parameter model (K2P) (Kimura, 1980) by MEGA7. The bootstrap consensus tree was generated with 1000 replicates (Felsenstein, 1985).

Depending on the availability of specimens, two to three specimens of each species were chosen for extraction and sequencing. DNA extraction and COI sequencing only worked for two specimens of *Neodexiopsis omnicapilli* sp. nov. The outgroups used in the COI analysis were chosen based on the cladistic analysis of Couri and Pont (2000) (all previously available in GenBank, except *Stomopogon* sp.). The ingroup was composed of seven *Neodexiopsis* species, two of which are represented in the GenBank through their sequences, and the COI sequences of the five additional species were sequenced in this work from PWR specimens (Table 1). All species used in this study are presented in Table 1. Adults were identified based on the available South American species key or original descriptions and by comparison of specimens of Coleção de Entomologia Padre Jesus Santiago Moure, Departamento de Zoologia da Universidade Federal do Paraná. Curitiba, Paraná, Brazil (DZUP).

RESULTS AND DISCUSSION

Taxonomy

***Neodexiopsis omnicapilli* sp. nov.**
(Figs. 1–3)

Diagnosis

Body mostly covered with long apically curled setulae (postpronotal lobe, anepisternum, katepisternum, legs and abdomen), a characteristic is not found in any other species of *Neodexiopsis*. Antenna and arista dark brown; ocellar seta long; height of gena similar to postpedicel (Fig. 1A). Scutum grey dusted, with 3 darker brown vittae along the *dc* and *acr* lines, the *dc* larger, reaching the scutellum apex (Fig. 1B). Legs yellow, femora *d* darker brown, tarsi dark brown (Fig. 1C).

Description

Male. Body length: 3.1–3.6 mm; wing length: 3.1–3.8 mm.

Color. Head. Ground-color grey. Face and parafacial yellow dusted; fronto-orbital plate and gena grey dusted; and ocellar triangle light brown dusted. Antenna, pedicel and

postpedicel dark brown and Palpus dark brown. Thorax. Ground-color grey. Calypters whitish and halter yellowish. Wing hyaline, brownish. Pleurae grey dusted. Abdomen. Ground-color grey. All tergites with brown vitta on center and quadrangular spots on lateral region (Fig. 1B).

Head. Eyes setulose with sparse and small setulae; at level of anterior ocellus separated by 1/4 of head width. Ocellar setae long and forwards directed. Postocellar seta well developed with half-length Ocellar seta. Inner vertical setae convergent and outer vertical setae divergent, both setae similar length to postocellar seta. Frontal row with 3 pairs of long setae and 4 pairs less developed. Antenna. Postpedicel 3 times as long as pedicel; arista short pubescent; gena-height as long as pedicel (Fig. 1A).

Thorax. *acr s* 3+6; *dc s* 2+3, one stronger presutural seta preceded by a second short seta; *ial s* 1+2; *spal s* 1+1; *pal s* 2 well developed setae; *b pprn s* 2; *npl s* 2, nopleura setulose; *b sctl s* and *ap sctl s* well developed; *anepst s* 8, first one longer.

Legs. Fore tibia with 1 *d* preapical seta. Mid tibia with 1 *d*, *a*, *v* seta. Hind tibia with 1 *v* seta.

Abdomen. Sternite 5 triangular, covered by cilia (Fig. 2A). *syntgst 7+8* completely fused (Fig. 2B).

Terminalia. *cerc* longer than wide, with an anterior incision (Fig. 2C). *sur* long, the same length of *cerc*; covered by long cilia on interior surface (Figs. 2D, E). *hypd* tubular and long. *phapod* apically curved (Fig. 2F). *epiph* short. *pregt* and *pgt* with similar length; *pgt* with a hook-like tip (Fig. 2F).

Female. Unknown.

Material examined. ♂ Holotype: “BRAZIL: Paraná, Palmas, malaise trap, 26°53'92" S, 51°61'14" W, 1115 m, 06.ix.2012, leg. Adriana C. Pereira” (DZUP); 2 ♂♂ Paratypes: “BRAZIL: Paraná, Palmas, Malaise trap, 26°53'92" S, 51°61'14" W, 1115 m, 06.ix.2012, leg. Adriana C. Pereira” (DZUP); 1 ♂ Paratypes: “BRAZIL: Paraná, Palmas, Malaise trap, 26°53'92" S, 51°61'14" W, 1115 m, 20.xii.2012, leg. Adriana C. Pereira” (DZUP).

Geographical distribution. Brazil (Paraná, Palmas).

Comments. The holotype has some head and thorax setae missing. The head and abdomen of one paratype were removed to analyze the the proboscis and terminalia, respectively.

Etymology: The specific name refers to the strange body morphology, covered with seta. From the latin *omni*= all, and *capilli*= hair.

Neodexiopsis rava Snyder, 1957

Material examined. 2 ♂♂: "BRAZIL: Paraná, Palmas, malaise trap, 26°53'92" S, 51°61'14" W, 1115 m, 26.vii.2014, leg. Adriana C. Pereira" (DZUP); 1 ♂: "BRAZIL: Paraná, Palmas, malaise trap, 26°53'92" S, 51°61'14" W, 1115 m, 08.vii.2014, leg. Adriana C. Pereira" (DZUP).

Geographical distribution. Argentina (Tucumán, Tafi del Valle) and Brazil (Paraná, Palmas).

Species identification

Neodexiopsis omnicapilli sp. nov. runs to couplet 18 of the key to *Neodexiopsis* in the collection of the Fundación Miguel Lillo (Snyder 1957),but differs from both species by having most of body with many long apically curled setulae (postpronotal lobe, anepisternum, katepisternum, legs and abdomen); palpi grey; thorax with three brown vittae, median vitta extending onto base of scutellum; abdomen cylindrical, bigger than thorax. In the key of Brazilian species of *Neodexiopsis* (Costacurta et al., 2005), runs to couplet 22 but differs from both options by having postpedicel and palpus dark brown, body setulose and sternite 5concolor with abdomen.

The reduced epiphallus seems to be an exclusive character of this new species, but the other genital characters are consistent with *Neodexiopsis* species. There is not autapomorphic character to *Neodexiopsis* (Couri and Pont, 2000), and three preapical dorsal setae on hind

femur, the synapomorphic character of *Neodexiopsis* and *Cordiluroides*, is not distinguishable in *N. omnicapilli* sp. nov. due the legs being covered by many setae.

Adult proboscis

In the analysis of SEM images of *Neodexiopsis omnicapilli* sp. nov. (Figs 3A-E) has four singles pointed hook-like teeth in the first row, presenting a broad base and concave external surface (Fig. 3E), these characters also was found in *N. rufipes* (Patitucci and Couri, 2017). Besides that, we observed a reduction in the number of pseudotracheae (Fig. 3B), a common morphological feature of predaceous species (Elzinga and Broce, 1986). The morphology of the proboscis *N. omnicapilli* sp. nov. and *N. rufipes* is very similar .

Barcode analysis

In order to confirm that the new species belongs to the genus *Neodexiopsis*, we used the mitochondrial COI gene sequences of four species of *Neodexiopsis* which are also distributed in PWR and two other *Neodexiopsis* species from the Genbank.

We provided the first COI sequence of five *Neodexiopsis* species and the first sequence of the genus *Stomopogon* (*Stomopogon* sp.). Besides that, thirteen newly collected sequences of five species (*N. neoaustralis*; *N. nigerrima*; *N. omnicapilli* sp. nov.; *N. paulistensis*; *N. rava*) were included in this study (increasing from 4 to 9 species and from 103 to 116 genus sequences available on GenBank). The accession numbers of COI sequences, which we downloaded from GenBank, are available in Table 1.

The COI sequences analysis using NJ supported that *Neodexiopsis omnicapilli* sp. nov. belongs to the genus *Neodexiopsis*. *Neodexiopsis omnicapilli* sp. nov. is more closely related to *N. paulistensis* and *N. rava*. The topology of COI tree of the genera was consistent with the morphological analysis of Couri and Pont (2000). Since the Maximum-likelihood analysis resulted in an identical topology as the NJ analysis, only NJ tree is presented.

The result supported the validity of all *Neodexiopsis* species, as indicated in the high interspecific divergence (0.064-0.117). The conspecific K2P divergence of *Neodexiopsis* species range from 0.000 to 0.004, whereas sequence divergence between species ranges between 0.064 and 0.117 (Table 2). The maximum within-species K2P distance was in *N. neoaustralis*, *N. nigerrima*, *N. omnicapilli* sp. nov and *N. rava* (0.004), and the minimum K2P

distance between species of the genus was 0.064, the same value as among *N. omnicapilli* sp. nov., *N. paulistensis* and *N. rava* (Table 2).

CONCLUSIONS

The taxonomy on the most speciose Diptera groups is a challenge. *Neodexiopsis* is one the richest muscid genus from the Neotropical region. We found that the molecular approach in this study was useful to confirm that *N. omnicapillis* belongs to *Neodexiopis*, despite its remarkable morphology, corroborating the morphological approach.

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FIGURES

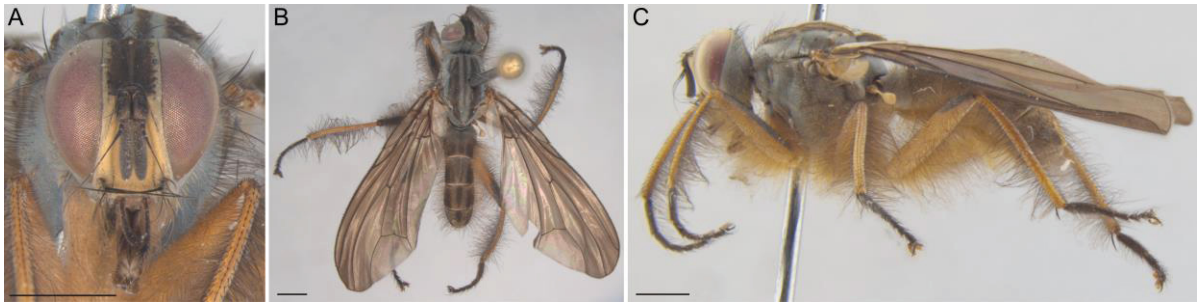

Fig. 1. *Neodexiopsis omnicapilli* sp. nov. (A) Head, anterior view. (B) Dorsal view.

(C) Lateral view. Scale: 1.0 mm.

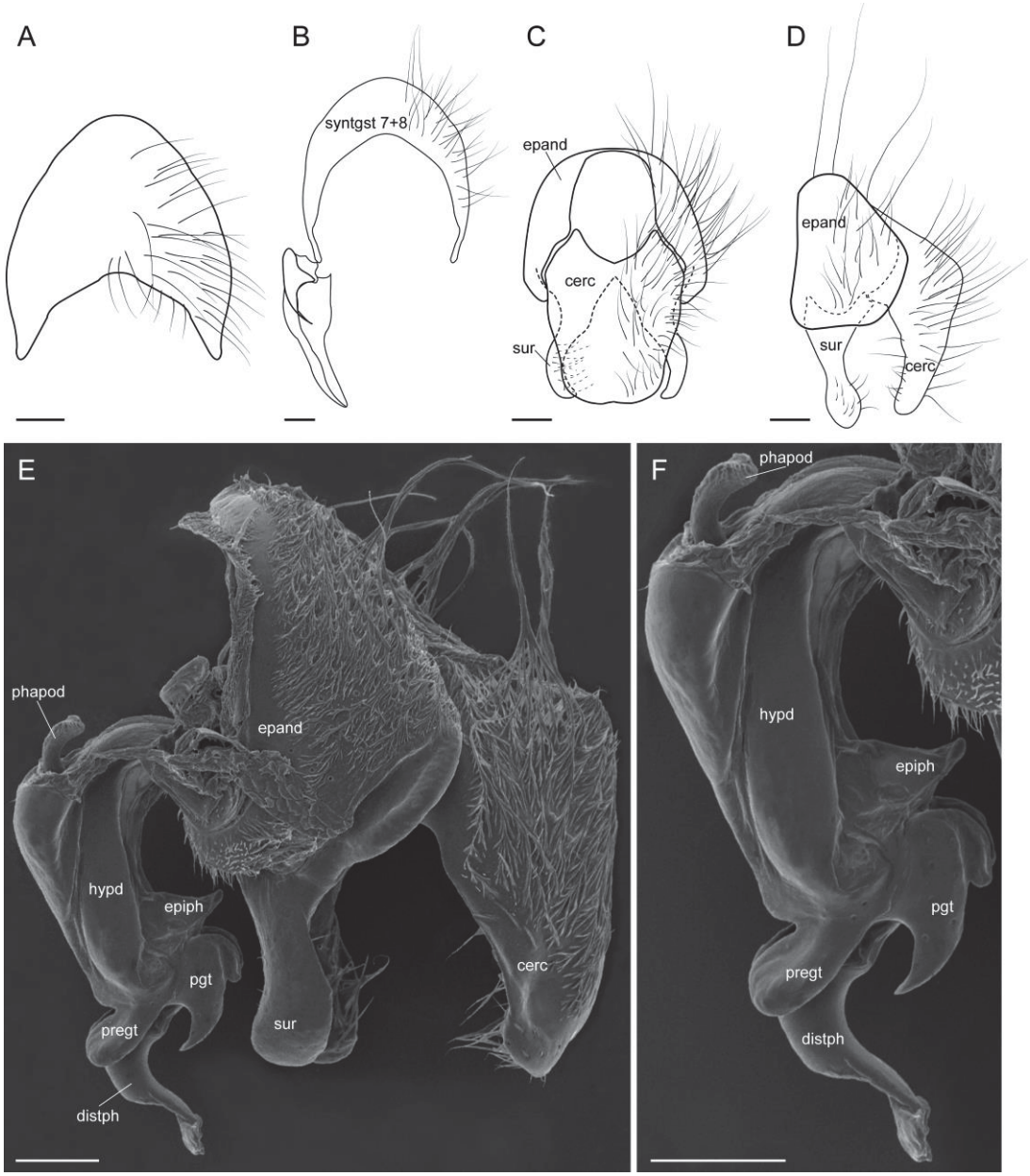

Fig. 2. *Neodexiopsis omnicapilli* sp. nov. (A) sternite 5, dorsal view. (B) syntergosternite, dorsal view. (C) epandrium, cercus and surstyli, dorsal view. (D) epandrium, cercus and surstyli, lateral view. (E) SEM of epandrium, cercus, surstyli and hypandrium, lateral view. (F) SEM of hypandrium, lateral view. (Abbreviations: cerc, cercus; distph, distiphallus; epand, epandrium; epiph, epiphallus; hypd, hypandrium; pgt, postgonite; phapod, phallapodeme; pregt, pregonite; sur, surstylus; syntgst, syntergosternite). Scale: 0,1 mm.

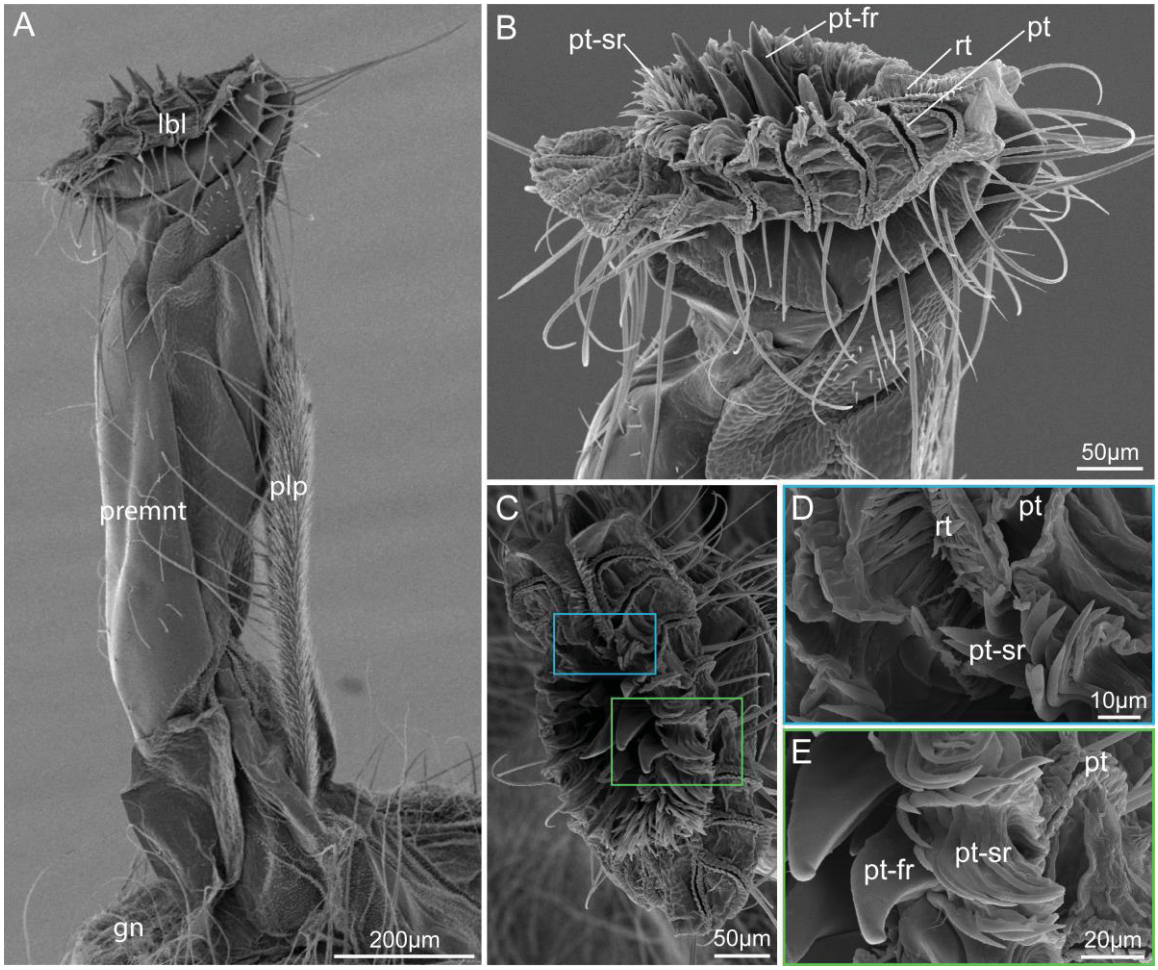

Fig. 3. Scanning Electron Microscope (SEM) micrographs of the proboscis of *Neodexiopsis omnicapilli* sp. nov. (A) proboscis lateral view. (B) labela, lateral view. (C) labela, distal view. (D) Detailed image of rasp-tongue (blue square). (E) Detailed image of prestomal teeth, first and second row (green square). (Abbreviations: lbl, labela; plp, palpus; premnt, prementum; pt, pseudotrachea; pt-fr, prestomal teeth, first row; pt-sr, prestomal teeth, second row; rt, rasp-like tongues).

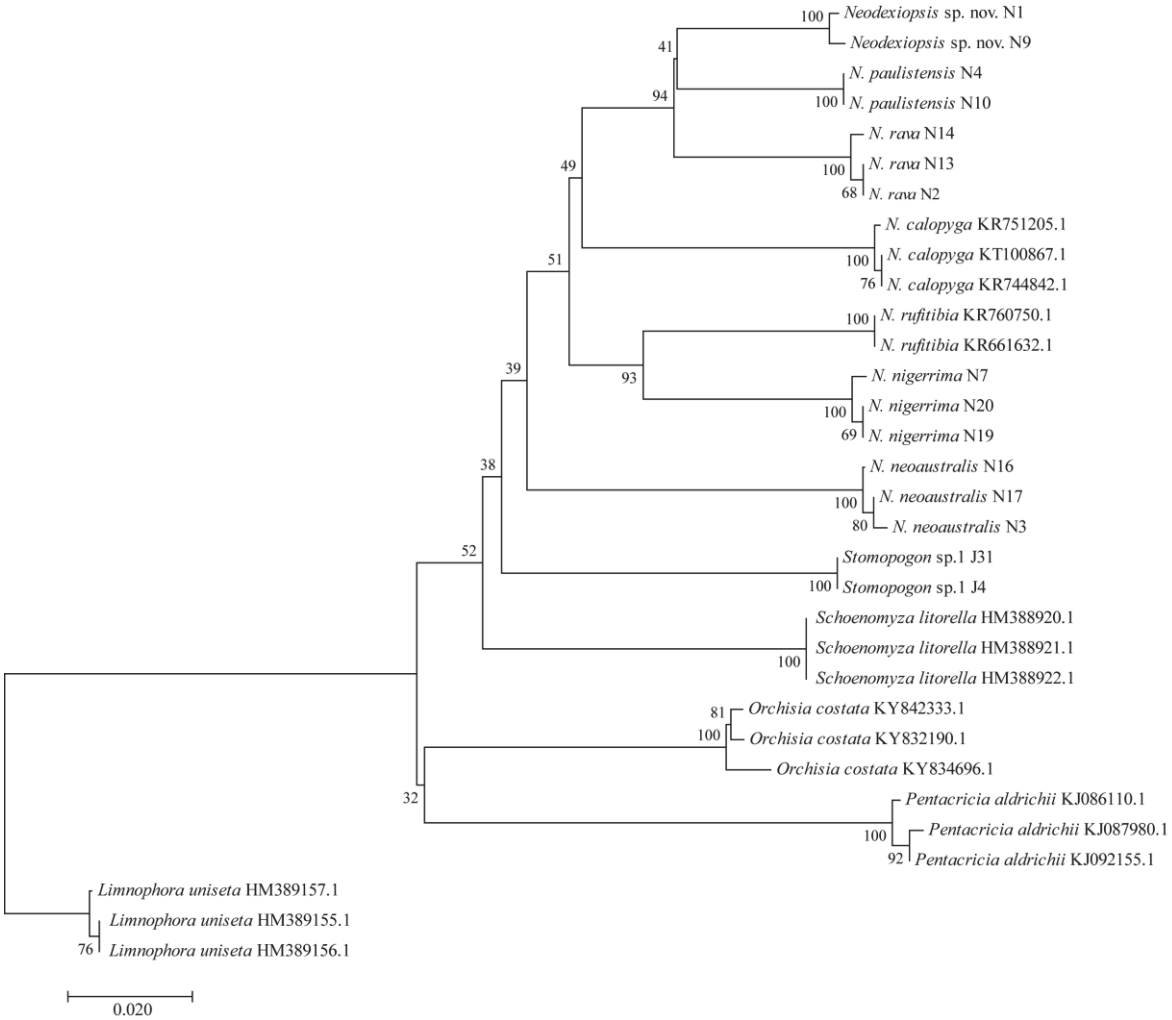

Fig. 4. Neighbour joining (NJ) tree of *Neodexiopsis* based on pairwise distances of COI sequences. Morphological species identification and GenBank no. are given in the specimen label. Numbers on branches indicate the bootstrap support values (1000 replicates). Evolutionary distance divergence scale bar is 0.02.

TABLES

Table 1. Details of *Neodexiopsis* species and outgroup processed in the study along with the GenBank Accession numbers. *new record; #newly collected COI sequences from PWR.

Species	**Genbank Acc. No.**	**Neotropical Distribution (Löwenberg-Neto and de Carvalho, 2013)**
Limnophora uniseta Stein, 1916	HM389155; HM389156; HM389157	-
Neodexiopsis calopyga (Loew, 1872)	KT100867; KR751205; KR744842	Brazil; Peru.
Neodexiopsis neoaustralis Snyder, 1957	#	Argentina; Brazil.
Neodexiopsis nigerrima (Malloch, 1934)	#	Argentina; Brazil; Chile.
Neodexiopsis omnicapilli **sp. nov.**	#	Brazil*
Neodexiopsis paulistensis Albuquerque, 1956	#	Brazil
Neodexiopsis rava Snyder, 1957	#	Argentina; Brazil*.
Neodexiopsis rufitibia (Stein, 1919)	KR760750; KR661632	Argentina, Brazil, Ecuador, Panama, Paraguay, Peru.
Orchisia costata (Meigen, 1826)	KY842333; KY832190; KY834696	-
Pentacricia aldrichii Stein, 1898	KJ086110; KJ087980; KJ092155	Ecuador
Schoenomyza litorella (Fallen, 1823)	HM388920; HM388921; HM388922	-
Stomopogon sp.	#	Brazil

Table 2. Pairwise of sequence divergent within *Neodexiopsis* species and outgroup based on Kimura-2-parameter model (K2P).

Species	n	Luni	Ncal	Nneo	Nnig	Nomn	Npau	Nrav	Nruf	Ocos	Pald	Slit	Ssp
Luni	3	**0.002**											
Ncal	3	0.165	**0.002**										
Nneo	3	0.154	0.114	**0.004**									
Nnig	3	0.154	0.099	0.096	**0.004**								
Nomn	2	0.150	0.091	0.094	0.095	**0.004**							
Npau	2	0.145	0.095	0.117	0.097	0.064	**0.000**						
Nrav	3	0.152	0.109	0.108	0.095	0.064	0.064	**0.004**					
Nruf	2	0.148	0.103	0.096	0.073	0.093	0.093	0.097	**0.000**				
Ocos	3	0.135	0.135	0.120	0.118	0.125	0.125	0.110	0.123	**0.010**			
Pald	3	0.164	0.158	0.154	0.135	0.135	0.141	0.151	0.143	0.126	**0.004**		
Slit	3	0.148	0.104	0.102	0.113	0.096	0.115	0.120	0.117	0.100	0.126	**0.000**	
Ssp	2	0.139	0.113	0.098	0.111	0.105	0.121	0.115	0.105	0.120	0.154	0.102	**0.000**

The numbers of intraspecific distances are shown in boldface for clarity. Numbers underlined indicate the highest intraspecific distance and the lowest interspecific distance. n = No. of sequences. Luni = *Limnophora uniseta*; Ncal = *Neodexiopsis calopyga*; Nneo = *Neodexiopsis neoaustralis*; Nnig = *Neodexiopsis nigerrima*; Nomn = *Neodexiopsis omnicapilli* sp. nov.; Npau = *Neodexiopsis paulistensis*; Nrav = *Neodexiopsis rava*; Nruf = *Neodexiopsis rufitibia*; Ocos = *Orchisia costata*; Pald = *Pentacricia aldrichii*; Slit = *Schoenomyza litorella*; Ssp = *Stomopogon* sp.

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